



# University of Waikato Summer Research Programme



# Te Wānanga o Ngā Kete – Division of Arts, Law, Psychology, & Social Sciences



# #wokeaf: The evolution of a hashtag



## RESEARCH AIM #whatisthepoint

Understand how the meaning of **#wokeaf** on Twitter has evolved over time.

## BACKGROUND #notjustatag

Hashtags were initially intended to serve a tagging function, grouping tweets related to the same topic together [1]. However, over time hashtags are increasingly being used as 'meta-comments' that provide extra conceptual information and act as stance indicators [2], each often possessing their own unique meaning and functioning as words or phrases in their own right.

## DISCUSSION #sowhat?

Most existing research in this field has looked at the evolution of groups of undifferentiated hashtags. We instead carefully tracked a specific hashtag over ten years.

We found that the hashtag **#wokeaf**:

- ✓ is imbued with referential meaning
- ✓ has a grammatical function
- ✓ is changing in complexity over time

## ACKNOWLEDGEMENTS

Andreea Calude for her supervision, support and guidance. University of Waikato Summer Research Scholarship for funding and facilitating the project. David Tyre for his contribution to the project in collecting, sampling and cleaning of the data for analysis

#thanksthat

## METHOD #howitwasdone

Collected tweets posted between 2012-2022 containing **#wokeaf**

Randomly sampled 50 tweets from each year were to create a corpus of 550 tweets

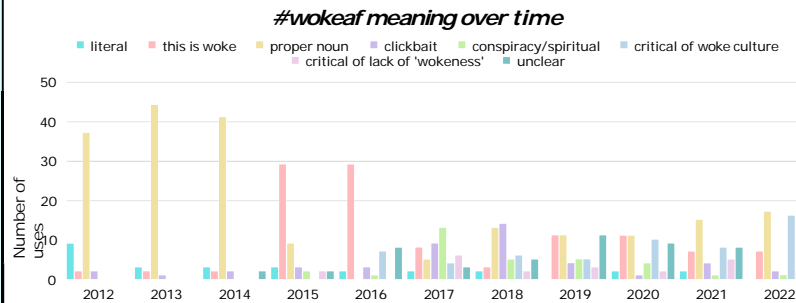
Manually coded sampled data set for meaning, syntactic integration, use, stance and hashtag position

Analysed full data set using AntConc corpus linguistics software to identify trends

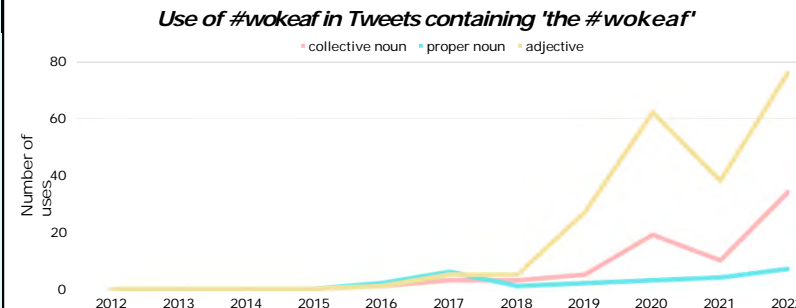
Tweets containing popular word combinations manually coded

## FINDINGS #whatdidwelearn

Literal use of **#wokeaf** (meaning awake) tapers off over time, demonstrating a shift from a literal meaning to more abstract meanings. No singular meaning accounted for more than 35% of all tweets in a given year from 2017 onwards, highlighting that the meaning of **#wokeaf** is becoming more diverse.



'The **#wokeaf**' was one of the most commonly occurring word combinations, even though this combination was not utilised until 2016. Tweets containing this combination predominantly used **#wokeaf** as a collective noun, suggesting **#wokeaf** has recently evolved to serve as a reference to a group of people.



## REFERENCES

- Calude, A. (2023). *The Linguistics of Social Media: An Introduction*. Routledge.
- Matley, D. (2018). "Let's see how many of you mother fuckers unfollow me for this": The pragmatic function of the hashtag #sorrynotsorry in non-apologetic Instagram posts. *Journal of Pragmatics*, 133, 66-78. <https://doi.org/10.1016/j.pragma.2018.06.003>
- Scott, K. (2015). The pragmatics of hashtags: Inference and conversational style on Twitter. *Journal of Pragmatics*, 8-20. <https://doi.org/10.1016/j.pragma.2015.03.015>

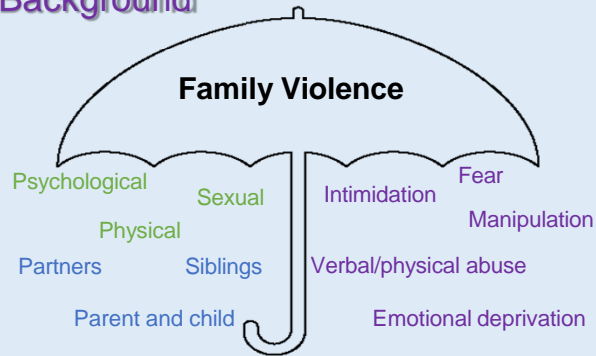


# Family Violence Response Pathways

Abi Astridge Clarke

Supervised by: Apriel Jolliffe Simpson & Devon Polaschek  
University of Waikato Summer Research Scholarship

## Background



Family violence (FV) is a significant social and economic issue worldwide, that directly impacts families/whānau (1).

Governments invest money and resources into agencies that allocate resources to support victims and prevent FV (2). FV costs Aotearoa \$4.1-\$7 billion yearly (3).

## Integrated Safety Response (ISR)

The ISR is a multi-agency partnership responsible for allocating interventions to whānau experiencing FV in the Waikato region and parts of Canterbury (2).

## Aim

To understand how the ISR provides support to whānau experiencing FV in Waikato.

## Method

Collect FV cases with first episode reported between 1-5 Feb 2022

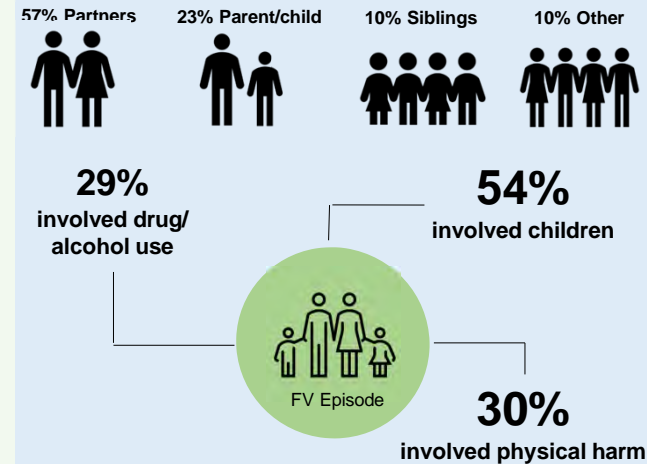
Collect tasks and interventions ISR allocated

Analysis:



## Results

N = 105



- ~1% of cases were labelled as high risk by ISR
- ~50% of whānau were offered an intervention
- ~20% of whānau engaged with the intervention
- 45% of cases had a positive outcome
- 34% of cases had a recurrent episode

## Next steps

- Collect a larger sample
- Run regression analyses to understand the impact of intervention



# What makes retail premises vulnerable to ram raids?

Danika Bridge, Kayla Hollows, & Dr Lisa Tompson

## Background

- Media reports focussed on ram raids in the last year, causing concern for the business community in Aotearoa (RNZ, 2022).
- It is unclear what makes retail premises vulnerable to ram raids, and what security features prevent ram raid victimisation.
- Our study explored how to collect data about security features and ram raid victimisation by interviewing businesses in the Hamilton CBD.

## Research Questions

- What security features prevent retail premises from experiencing ram raid victimisation?
- How can we collect data about security features and ram raid victimisation?

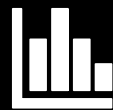
## Method



**Designed a questionnaire**  
Shaped by existing knowledge on retail crime prevention and ram raids.



**Spoke with experts**  
Liaised with the Hamilton Neighbourhood Policing Team to hear their experiential knowledge.



**Consulted the data**  
Identified recruitment areas using Police data about ram raids in the Hamilton CBD.



**Conducted interviews**  
We contacted 37 businesses, and completed 10 interviews.

## Emerging Hypotheses

- Bollards are the most effective deterrent for ram raids compared with other types of security.
- Security measures such as emptying tills and/or bolting them down decreases the likelihood of ram raid revictimization.
- Retailers are more concerned about violent crime during store hours, than ram raids out of hours.

## Next Steps

- Continue conducting interviews.
- Extend the recruitment area to provide a larger sample size.
- Compare data about the prevalence of ram raids with other forms of violent retail crime.



# BEHAVIOURAL INDICATORS OF SLEEP IN THE HUMAN FETUS

Alyssa Erasmus, Jessica Leov and Vincent Reid

## BACKGROUND

There is currently no standard measure of fetal sleep. When studying fetal behaviour, it is important to understand whether non-responses are due to sleep or environmental/cognitive factors. This study aims to explore behavioural indicators of fetal alertness by observing eye movements and heart rate.

## METHODS

- 32 singleton fetuses between 33 - 35 weeks gestations ( $m = 33.9$  weeks).
- Pregnant people participated in one 2D ultrasound at Waikato Hospital in which the fetal head was observed in the transverse plane at two separate time periods (six minutes total).
- Fetal eye movement was observed across two conditions. Condition one served as a baseline. Condition two followed the presentation of light and sound through the maternal wall. Fetal heart rate was recorded at the start of the first condition.
- The fetal lens was observed via ultrasound, with the number, direction, and duration of movements recorded manually by a trained observer.
- A fetal eye movement was defined as a lens movement from a stationary position through a position change to another stationary position.



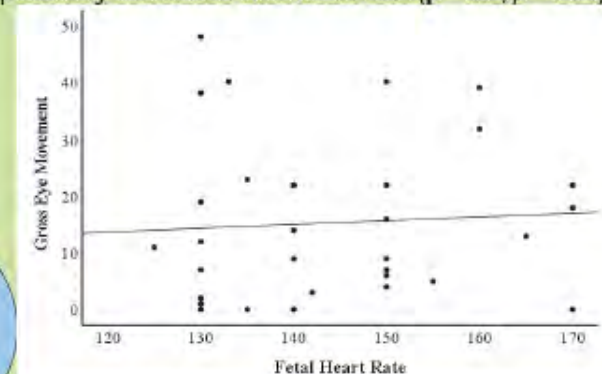
## INVESTIGATING INDEPENDENT MEASURES OF FETAL ALERTNESS

### PRIMARY FINDINGS

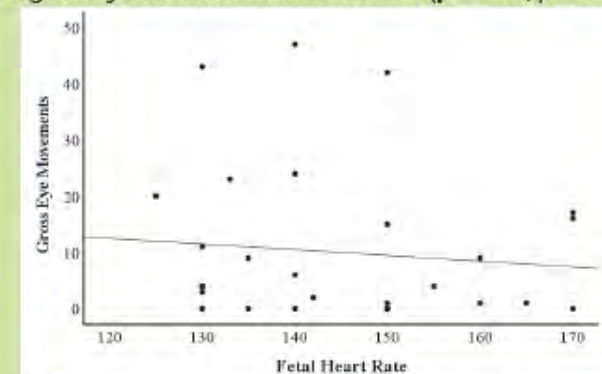
- No strong correlation between fetal heart rate and eye movements.
- Fetal alertness maintains across conditions for the observed time period.
- Eye movement and heart rate alone are not sufficient markers of alertness. Further research should investigate limb and head movements, as well as continually monitor fetal heart rate.

## RESULTS

Eye movements in condition one were found to be weakly positively correlated with heart rate ( $\rho = .115$ ,  $p = .523$ ).



Eye movements in condition two were found to be weakly negatively correlated with heart rate ( $\rho = -.132$ ,  $p = .463$ ).



Eye movements in the first condition were found to be positively correlated with eye movement in the second condition ( $\rho = .534$ ,  $p = .001$ ), which suggests that fetuses are likely to maintain responding across conditions.

## FURTHER READING

Reid, V. M., & Dunn, K. (2021). The Fetal Origins of Human Psychological Development. *Current Directions in Psychological Science*, 30(2), 144-150.  
Donovan, T., Dunn, K., Penman, A., Young, R. J., & Reid, V. M. (2020). Fetal eye movements in response to a visual stimulus. *Brain and Behavior*, 10(8), e01676.

## ACKNOWLEDGMENTS

The Royal Society Te Apārangi, Ngā Pou Kokiri o Waikato, Te Whatu Ora (Waikato DHB), Martin Necas (sonographer), and Waikato Hospital.  
Special thanks to The University of Waikato Summer Research Project and Maddy Cosgrave (research assistant) for their contributions.



# RAM RAIDS: WHAT IS MAKING RETAIL PREMISES VULNERABLE?

KAYLA HOLLOWS  
DANIKA BRIDGE  
DR LISA TOMPSON



## INTRODUCTION

Ram raids, where a vehicle is used to gain access to a premises for the purpose of stealing is not a new problem.

Recent media coverage suggests ram raids are becoming more frequent and brutal, and this is causing fear among retailers and the public.

We need to understand what makes retail premises vulnerable to ram raids and what security features work to prevent them from being targeted.

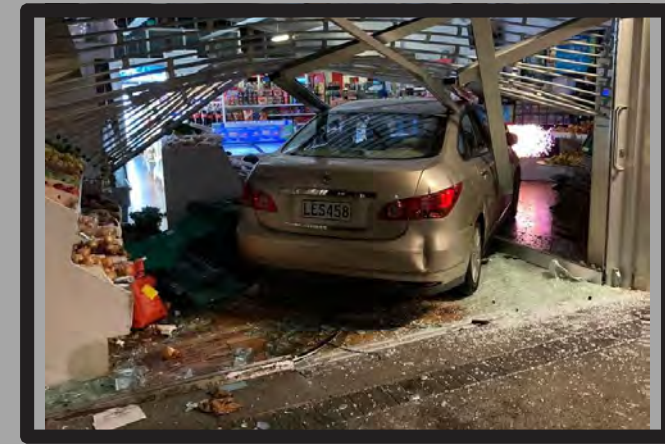


PHOTO CREDIT TEWAHANUI.NZ

## AIM

To see what types of security features, in isolation or combination can and will provide optimal prevention potential. We also aimed to see if our method of data collection was viable.

## METHOD



Designed environmental survey



Consulted with police and Hamilton City Council



Conducted interviews with retailers



Explored police data



Adjusted survey to keep it relevant.



Overcame hurdles in the recruitment process. Christmas rush, staff on leave, time around workers schedules



The project would benefit from more time, a different time of year and;



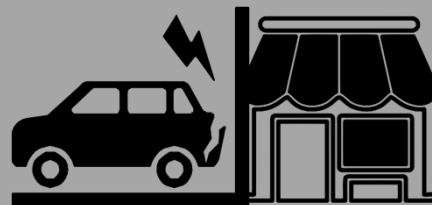
Ongoing data collection

## INSIGHTS GENERATED

We have had some great feedback from retailers. Our findings suggest that ram raids aren't the problem, but smash and grabs are.

## References

Jacques, C. (2005) *Ram raiding: the history, incidence and scope for prevention.*  
Clarke, R.V. (2002) *Burglary of Retail Establishments.*



## NEXT STEPS



Continue to recruit retailers to take part in the survey



Expanding the location area for the survey



Share findings with police and Hamilton City Council



Compare police data and survey findings

# CRYPTO-ASSETS

## BACKGROUND

Crypto-assets including NFTs (non-fungible tokens), utility tokens and crypto-currencies are a growing use of Blockchain technology.

## RESEARCH QUESTION

How does the law affect crypto-assets?

## METHOD

- Comprehensive review of court cases, regulations, law journals, books, websites, articles and video.
- Describe the technology of NFTs and other tokens.
- Apply the law to highlight issues for both buyers and sellers of crypto-assets.

## ISSUES EXPLORED

- Copyright and Trademark Acts
- Anti-Money Laundering
- Fair Trading Act and Guarantees
- Financial Service Providers Act
- Environmental Concerns
- Succession and Estate Planning
- Insider and Wash Trading
- Property (Relationships) Act
- Asserting Jurisdiction
- Privacy and Data Protection
- Theft, Hacking, and Deletion
- Taxation and Contract Law
- Is further regulation needed?



Where do they fit in?	Crypto-currency eg. Bitcoin	NFTs eg. Trump cards	Utility Tokens eg. Rhythm & Vines Token	Security Tokens eg. Siafunds
A crypto-asset ?	✓	✓	✓	✓
A financial security ?	X	X	X	✓
Legal tender in NZ ?	X	X	X	X
Exchanges for same of equivalent value?	✓	X	✓	✓
Proof of authenticity?	X	✓	X	X
Used for crypto-art or collectibles	X	✓	X	X

## RESULTS

Scan the QR code for a list of REFERENCES



- More than 7.5% of adult New Zealanders invested in crypto-assets in 2021.
- Whether you:
  - buy a Rhythm & Vines ticket as a utility token to exchange at the venue for a free drink, or
  - buy a fractional NFT as part ownership in real estate, or
  - use an NFT to authenticate a piece of art, or
  - something else; crypto-assets are likely to be part of your future.
- Crypto-assets remain volatile in value and susceptible to on-line theft or destruction.

## CONCLUSION

Crypto-assets have unique features that raise different legal issues when buying or selling them compared with other assets. At least 12 different laws can affect crypto-assets, however no new legislation has been passed in New Zealand to protect the consumer from its vulnerabilities. Beware.



Research by Karen Musson, with thanks to supervisors Professor Wayne Rumbles and Richman Wee. Thanks also to University of Waikato for funding.



THE UNIVERSITY OF  
**WAIKATO**  
*Te Whare Wānanga o Waikato*



## TELL ME WHAT YOU SEE?

### WHAT DO YOU SEE?

I SEE OUR TAONGA SITTING IN A FOREIGN PLACE WAITING FOR SOMEONE TO TALK TO THEM BUT THEN SILENCE...

### WHAT DO YOU SEE?

I SEE LIFE BEING DRAINED FROM ITS ESSENCE AS THE DYNAMICS DRAWS THEM BACK TO THE TIME OF THE SEPARATION OF RANGINUI RĀUA KO PAPATŪĀNUKU.

### WHAT DO YOU SEE?

I SEE OUR TAONGA TUKU IHO, INTRINSIC KNOWLEDGE, CONNECTING US BACK TO HAWAII.

### WHAT DO YOU SEE?

I SEE OUR TŪPUNA AND THEIR LIFE OF TOHUNGATANGA WHERE MANY WHAKAPAPA COLLABORATE THROUGH THE HANDS THAT MADE THEM.

### WHAT DO YOU SEE?

I SEE OUR RANGATIRA WHO ONCE RULED THESE LANDS BUT NOW OUR RANGATIRA RUN THE MARAE.

### WHAT DO YOU SEE?

I SEE TE IRĀ TĀNE ME TE IRĀ WĀHINE, AN ESSENCE MISUNDERSTOOD.

### WHAT DO YOU SEE?

I SEE OUR MAURI INTERTWINED IN DEEP CONNECTION AS I CRY TEARS OF AROHA OF THE SEPARATION FROM THEIR PEOPLE.

### WHAT DO YOU SEE?

I SEE THE AWA AND OUR TŪPUNA CALLING THEM HOME AS THE UNREST, UNSETTLES THE MAURI.



## Project 7 – Contemporary Māori Narratives and Te Whare Taonga o Waikato Collections: Creative Possibilities for Indigenous Public History.



### PROJECT

My project asks a seemingly simple question: what does it mean for taonga Māori to live in the whare taonga (museum)? Specifically, I wanted to understand how the institution of a museum might shape the possibilities for how tangata whenua are able to engage with taonga. Taonga for Māori are both of historical and whakapapa significance. Whakapapa defines our relational connection to our tūpuna but the stories that surround our taonga, can affect our relationships to them.

### Taonga: The Unseen and Unspoken – Kei whea te aroha?

My connection to our taonga is through my great-grandfather who retrieved the waka, my great great-grandfather who led the restoration of Te Winika, and my whakapapa to these tūpuna carved in these pou and whare waka. These are the foundations of aroha and admiration for our taonga. But most days sitting in this space next to Te Winika, was lonely, empty, dark, and visitors were few and far between. I could only imagine what it is like for our taonga in the Collections area.

Dr. Hinemoa Elder writes "The ancient sacred energy of aroha, the timeless wisdom of Māori culture." (Elder 2020)



### Engagement

This meant in practice, I engaged in the embodied process of autoethnographic research by spending time with museum educators and our taonga. It was only by being there, I began to understand the broader context taonga exist in. One example was seeing an art piece, captioning a town in the Waikato Maniapoto whenua, and was overlaid with colonial maps, presenting a disfigured interpretation of history. That incidental engagement with a colonial art piece, prompted questions which led to the creation of the poem.

Linda Tuhiwai Smith explains the understanding when land is changed, "...disconnects us from the songs and chants used by Indigenous people to trace their histories." (Smith 2012)

### Kaitiakitanga

Kaitiakitanga is entrenched in aroha and te ao Māori. Aroha is not just an emotion but a way of life. Both the physical and spiritual importance are significant to these lands, so too are the practices to protect and preserve our history and pūrakau of our taonga Māori.

Huanani Kay Trask explains "Our story remains unwritten. It rests within the culture, which is inseparable from the land. To know this is to know our history. To write this is to write of the land and the people who are born from her." (Trask 1993)



By Amanda Nelson (1336539) & Sam Iti Pendergrast  
ALPSS – School of Social Sciences

Smith, L. T. (2012). Decolonizing Methodologies: Research and Indigenous Peoples (2nd ed., p. 54). Otago University Press.

Elder, H. (2020). Aroha Māori wisdom for a contented life lived in harmony with our planet (1st ed.). Penguin.

Trask, H. K. (1993). From a Native Daughter: Colonialism and Sovereignty in Hawaii (Rev. ed., p. 121). Honolulu: University of Hawaii Press.

## WHAT DO YOU SEE?

I SEE HER OVERLOOKING THE TUPUNA AWA O WAIKATO, MOKEMOKE FROM THE MEMORIES WHEN SHE ONCE FLOWED FREELY THROUGH THE WATER SURROUNDED BY THE FLEET OF HER WAKA WHĀNAU.

## WHAT DO YOU SEE?

I SEE HER MOKEMOKE FOR THE CHILDREN FROM BACK HOME WHERE THEY WOULD FREELY PLAY AND SWIM WITH LAUGHTER OF JOY AND AROHA.

## WHAT DO YOU SEE?

I SEE THE TAONGA CALLING FOR US TO BRING THEM TO LIFE AGAIN, TO IDENTIFY THEM THROUGH WHAKAPAPA, TO AWAKEN THEIR MAURI, TO CONNECT WITH THEM AGAIN.

## TELL ME WHAT YOU SEE?

IF YOU DON'T SEE WHAT I AM SEEING, HOW CAN YOU BE A KAITIAKI?

## TELL ME WHAT YOU SEE?

IT'S WHAT YOU DON'T SEE THAT DISCONNECTS THE PHYSICAL FROM THE SPIRITUAL.

## TELL ME WHAT YOU SEE?

EVERY LINE SPEAKS OF THE UNDERSTANDING SPECIFIC TO OUR PEOPLE AND THE ENVIRONMENT WE KNOW.

## TELL ME WHAT YOU SEE?

WHO IS TELLING THE STORY?  
(Nelson 2022)





## BACKGROUND

Globally, there is an increasing desire for attention to the ethical and legal challenges brought up by e-mental health technology, and there is general consensus that more needs to be done to improve regulation and governance.<sup>1</sup>

Controversial incidents, stories in the media, and legal cases involving online mental health apps and services.



Read stories!

## PROBLEM



Mental health and wellbeing tools can involve risks of harm and privacy breaches. Sensitive information that a patient has shared with their medical provider may be compromised in an online-based cyberattack.<sup>2</sup>



## AIM



To develop an app would involve not only ensuring that all applicable laws, regulations, and policies were followed but also understanding how the app could be adapted to account for various international contexts.

## METHOD

The application would be designed with four key ideas: tracking and feedback, live support, social community, and security. To accomplish this, a Google Forms survey was conducted. Data was collected from 20 Waikato University students who had previously used mental health apps and services.

## RESULTS

- 20 of young adults completed our mental health survey.
- 51% felt that a mental health app should not store any of their detailed data in the cloud.
- 83% strongly disagreed that specific information gathered through a mobile mental health app should not be shared with a third party.
- According to the findings, data type, data stage, privacy victimisation experience, and privacy awareness all have a positive impact on privacy concerns.

## CONCLUSION

The findings of the survey showed that it is critical to raise awareness about privacy-preserving apps among users and health professionals. The development of mental health apps must adhere to practices that ensure privacy by design. An effective app will demonstrate appreciation for ethical research that aims to contribute to the creation of more secure and privacy-protecting online mental apps.<sup>3</sup>

## REFERENCES

1. Piers Gooding and Richman Wee. (2021) Ethics and law as essential to e-mental health. <https://mail.google.com/mail/u/2/?ogbl#search=richman%20wee%20R2BF2P-wVdKChwghWmcBTFI%20projector%20messagePartId=03>.
2. Regis College Telehealth Mental health care, delivered through the internet (29 October 2021).
3. Leonardo Horn Inyang. (2022) On the privacy of mental health apps: An empirical investigation and its implications

# Understanding Police Shooting Events

Bridget O’Keeffe, April Jolliffe Simpson, & Devon Polaschek

## Background

Police use of deadly force is a global conversation that has become increasingly important in Aotearoa New Zealand. (O’Brien, 2021)

Police shooting events are high-stress and unfold rapidly; Police are required to make critical decisions in the blink of an eye.

(Luini & Marucci, 2015)

But what turns a routine call-out into a Police shooting event? And how do these events typically progress?

## Aim

To understand the behavioural and contextual factors that lead to Police using firearms.

## Method

We examined Independent Police Conduct Authority (IPCA) reports published from 2019 – 2022 about events where police used firearms between 2017 – 2020.

Collect reports from  
IPCA website

Record descriptive  
statistics about  
events

Analysis

~ 1/2 of Police shooting events  
sampled were fatal



~ 1/4 of offenders displayed  
suicidal behaviour



On average 6 Police officers  
attend each event



Most offenders were known to  
Police



3/4 of Police shooting events  
involved a vehicle



The Bay of Plenty was the most  
common location for Police  
shooting events

## Preliminary Results

The most common behaviours preceding Police officers firing a weapon at an offender were:

- Police aiming a firearm at an offender
- Other officers firing at an offender
- An offender firing at Police

The most common behaviours preceding Offenders firing a weapon at Police were:

- Offenders aiming a firearm at Police
- Police firing at an offender
- Police engaging in a vehicle pursuit of an offender

## Next Steps

- Expand our sample to include all IPCA reports of Police shootings from 2010 – 2022.
- Qualitatively code and quantitatively analyse the chain of events in each report using behaviour sequence analysis.
- Identify common behavioural patterns in Police shooting events.

Code the sequence of  
behaviours in each  
shooting event

Analyse sequenced  
events

Identify common  
behavioural  
patterns in events

### References

- J O’Brien, A., Thom, K., Gordon, S., McKenna, B., Kidd, J., Quince, K., & Exeter, D.J. (2021). The nature of police shootings in New Zealand: A comparison of mental health and non-mental health events. *International Journal of Law and Psychiatry*, 74, 101648–101648.
- Luini, L. P., & Marucci, F. S. (2015). Prediction–Confirmation Hypothesis and Affective Deflection Model to account for split-second decisions and decision-making under pressure of proficient decision-makers. *Cognition, Technology & Work*, 17(3), 329–344



# Updating research on the Risk Need Responsivity model for correctional intervention:



## Piloting search terms and screening criteria

Zahra Rennie & Devon Polaschek

### Background

The Risk Need Responsivity (RNR) model is the gold standard for identifying which interventions increase or decrease a person's risk of re-arrest, reconviction, or reimprisonment.

#### The RNR Model (Andrews & Bonta, 2017)

**Risk:** Intervention matches the person's risk of reoffending e.g., higher risk = more intensive intervention.

**Need:** Intervention targets are related to risk of reoffending.

**Responsivity:** Intervention is tailored to the person and uses cognitive and social learning methods.

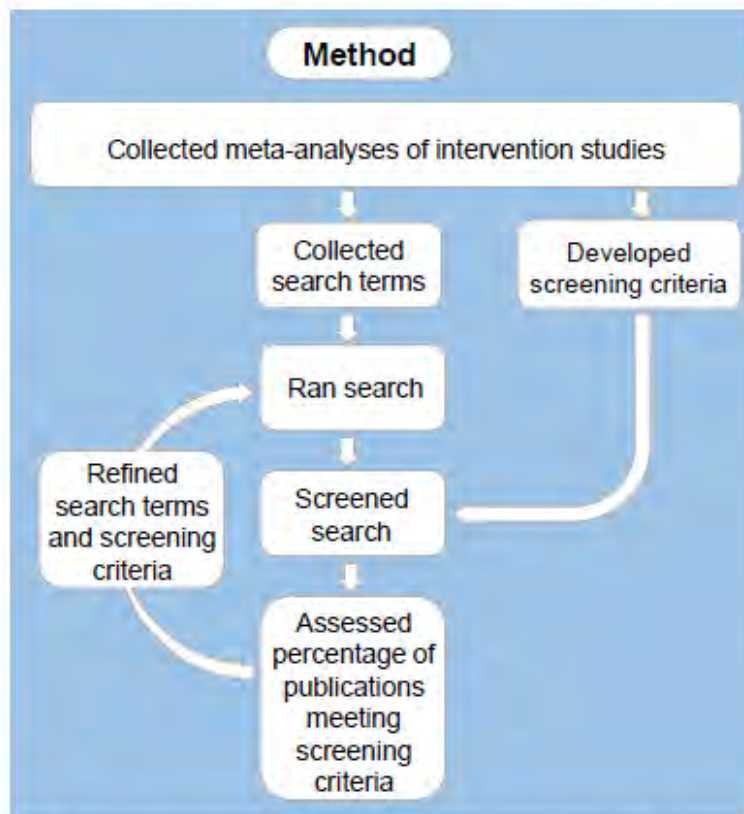
The model rests on meta-analyses of intervention studies conducted in the 1980s and 1990s—the most recent meta-analysis being conducted by Dowden (1999).

Since then, the range of interventions has expanded (e.g., bootcamps, mindfulness, or prison-based dog programs) making replication important for the continued credibility of the RNR model.

But intervention studies use different terms for the same concepts making them difficult to find.

### Aim

Pilot search terms and preliminary screening criteria to find eligible intervention studies for our meta-analysis using electronic database, PsycNet.



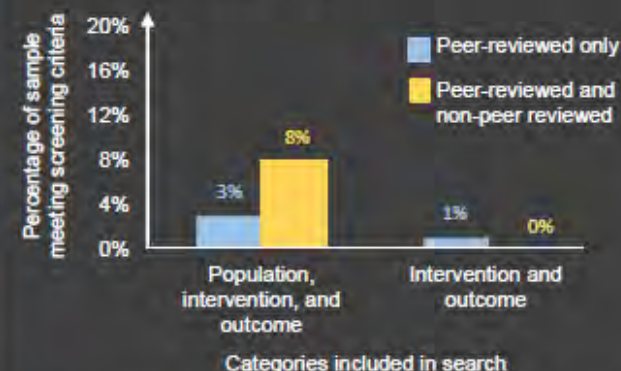
We combined search terms from 3 categories of related words.<sup>1</sup>

	Population	Intervention	Outcome
	e.g., offender*	e.g., treatment*	e.g., reoffend*
OR	perpetrat*	intervention*	reconv*
	detainee*	program*	reimprison*
	AND		

Different category combinations formed different boolean search expressions e.g., (offender\* OR perpetrat\*...) AND (treatment\* OR intervention\*...)

### Results

Percentage of publications meeting screening criteria from samples with different combinations of search categories, (n=100)



Note. Each sample of 100 studies was random and not mutually exclusive of each other.

### Discussion

Using population, intervention, and outcome search terms while including non-peer-reviewed publications resulted in the most eligible intervention studies per hundred.

Using standardized terms in intervention studies would make searches easier for future meta-analyses.

### References

Bonta, J., & Andrews, D. A. (2016). *The psychology of criminal conduct*. Routledge.

Dowden, C. (1998). *A meta-analytic examination of the risk, need and responsivity principles and their importance within the rehabilitation debate*. Unpublished master's thesis, Psychology Department, Carleton University, Ottawa.

<sup>1</sup>Table adapted from Tompson, L., & Belur, J. (2016). Information retrieval in systematic reviews: a case study of the crime prevention literature. *Journal of Experimental Criminology*, 12(2), 187-207. <https://doi.org/10.1007/s11292-015-9243-x>

# MEASURING THE SUCCESS

## PUNA WAIORA A MĀORI HEALTH WORKFORCE PIPELINE PROGRAMME

### 1. Background

Te Aka Whai Ora recognizes that Māori are under-represented across almost all areas within our health and disability sector.

The Puna Waiora programme focuses on increasing the number of Māori in the health and disability sector through targeted engagement with Rangatahi Māori and Whānau in secondary and tertiary education, and within the community, to pursue careers in health. There are five key programmes in which the team delivers across.

*"Empowering Rangatahi Māori and Whānau to pursue a career pathway in the Health Workforce"*

The overall aim is to grow the Māori health workforce across all areas of the health and disability sector. Two objectives will be used to contribute to achieving the overall aim.

1. Provide employment and career pathway opportunities.
2. Contribute to the development of a Māori health workforce.

The values at the core of this programme include;

- Hāpaitia, Whakamahuki, Whakawhaneke (to elevate, enlighten and develop)
- Whakatipu, Whakahononga Mahi, Hononga Hauora (to grow, place and connect rangatahi Māori and Whānau to health)
- Toitū Whiwhinga Mahi (to provide sustainable employment opportunities)

### 2. Aim

To produce an outline to guide the evaluation of the Puna Waiora programme.

### 3. My journey

- Working alongside the Māori Workforce Development and Puna Waiora teams at Te Whatu Ora and Te Aka Whai Ora Waikato
- Engaging with Rangatahi Māori and community organizations in Waikato
- Completing a review of literature to understand the background to the Puna Waiora Programme
- Working towards creating a plan for the evaluation of the Puna Waiora Programme
- Providing outlines of data collection methods

### 4. Project outcomes

An evaluation outline plan was produced to measure the effectiveness of the Puna Waiora programme.

Additional project tasks completed include:

Understanding the Puna Waiora Programme

Developing a survey

Engaging with the Puna Waiora team

Making recommendations

SCAN ME



### NGĀ HOTAKA | PROGRAMMES

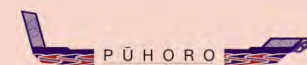
- Mahere Ako, which is supporting Rangatahi Māori in their chosen health career pathway.
- Rapua Pūtea assists Rangatahi in obtaining scholarships and providing support with student financial applications.
- Tuakana Kūmara which consists of mentoring & pastoral care services for rangatahi in Kura and Whare Wānanga and for whānau.
- Huarahi Hauora is providing cadetships for Rangatahi Māori and Whānau to transition into the workforce.
- Te Tomokanga is a gateway programme into placements, internships and earn as you learn opportunities.



WHAT WE PROVIDED TO TAUIRA IN YEARS 9 AND 10:

- An overview of our programme and how we can support them on their journey
- Exposure to the various career pathways within the health and disability sector
- Preparing taura to start considering the career pathway they want to pursue
- Building strong connections with taura to ensure that we continue to support them on their educational journey and into their chosen career path

Poster by Bella Rewiri-Wharerau  
Supervised by Bridgette Masters and Cindy Dargaville  
Special thanks to Khaliah Tapu and the Māori Workforce Development team at Te Whatu Ora / Te Aka Whai Ora Waikato  
Acknowledgements to University of Waikato Summer Research Program, Te Whatu Ora / Te Aka Whai Ora Waikato and to Pūhoro for providing me with this opportunity.



**Te Whatu Ora** Health New Zealand  
**Te Aka Whai Ora** Māori Health Authority  
Waikato



# IMMIGRATION: TIME AND RACE

## BACKGROUND:

In New Zealand, labour shortages in the horticulture and viticulture sectors have led to immigration policies designed to temporarily employ Pacific migrant workers. Like programmes in the 1950s and 1960s that recruited Pacific people for factory work, these policies position Pacific workers as 'low-skilled' and expendable.

## METHODS:

A review of immigration schemes aimed at Pacific countries to promote working in New Zealand and a document analysis of over 45 immigration policy documents.

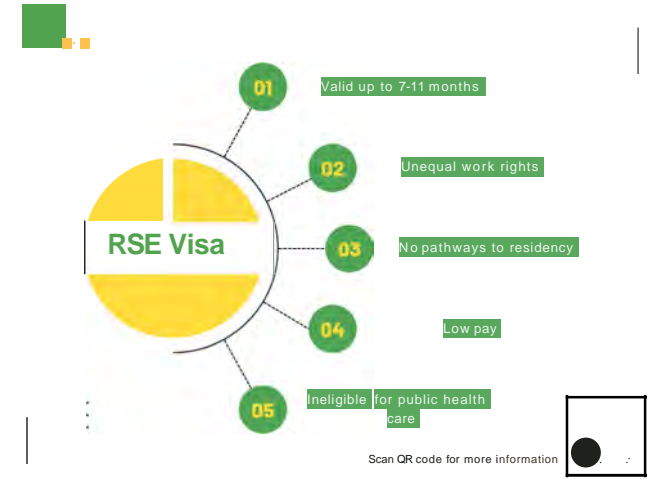
## AIM:

To identify how immigration schemes promoted towards Pacific countries have racist and colonial undertones.



## KEY FINDINGS:

In 2022, over 15,000 Pacific people worked under the RSE (Recognised Seasonal Employer) Visa. It is the most restrictive work visa issued in New Zealand:



## CONCLUSION:

Pacific migrant workers are vulnerable to exploitation within New Zealand's horticulture and viticulture sectors. The RSE visa system, and ineligibility for other immigration pathways, reinforce racist and colonial ideas that marginalize Pacific workers.

## ACKNOWLEDGEMENTS:

Designed by *Evalessi Tu'inukuafe*  
Supervised by *Dr. Ritu Parna Roy, Research Fellow, Te Ngira: Institute for Population Research and Professor Francis L. Collins, School of Social Sciences, University of Auckland.*





# Te Puna Ako – Centre for Tertiary Teaching and Learning

# Content analysis of student feedback

Rebecca Barker, Emma-Leigh Hodge & Rahat Hasan  
 Te Puna Ako: Centre for Tertiary Teaching and Learning

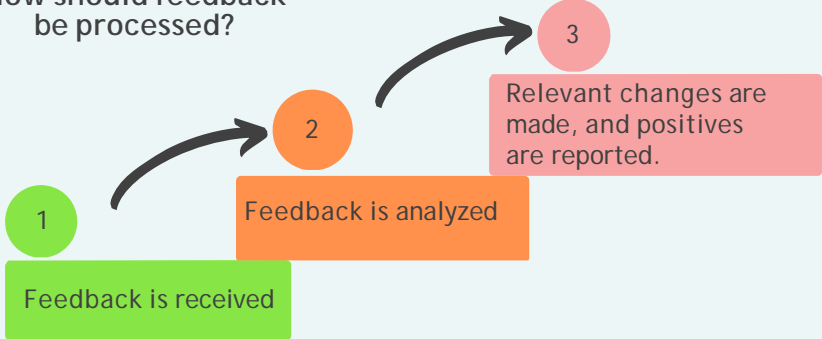


### What is the problem we want to fix?

Every semester the University of Waikato asks students for feedback on the papers they have undertaken and the teaching they have received. This is done so changes can be made where required and positives can be reinforced.

Some of the feedback is written which makes reporting on the responses difficult, as a result step 3 of feedback processing has been missing.

### How should feedback be processed?



### How is the problem going to be fixed?

A Natural Language Processor (NLP) was identified which would allow the written feedbacks to be given a numerical rating.  
 1=Negative comment  
 2=Neutral comment  
 3=Positive comment

This would allow the feedback to be more easily analysed and reported. How do we know that a computer can effectively code human response? That is where I come in. In order to prove that the NLP is effective we have to test it against human codes

### How did we do it?

We read some journals of previous studies to help us develop a coding framework.

After testing the framework, a sample of 1000 comments were coded.

The same sample was also run through the NLP for it to code.

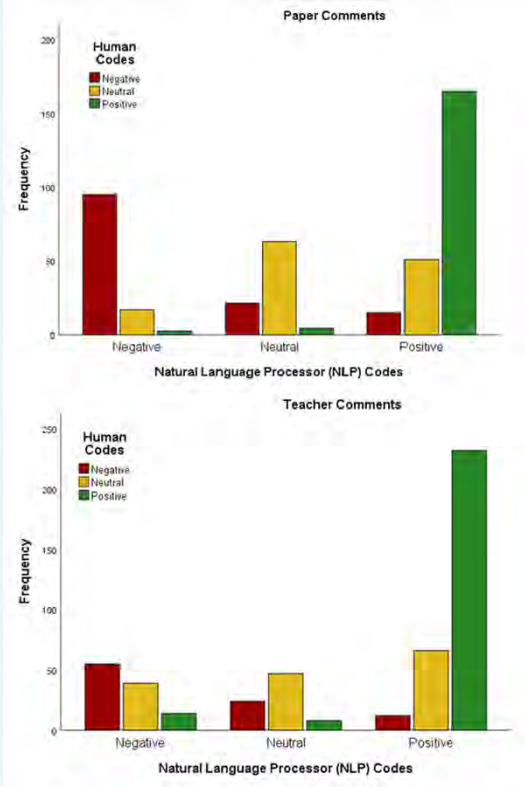
The human codes are then collapsed down to a 1-3 scale to match the NLP.

Finally, the coding scores are analysed to determine if the NLP can do the same job that a Human can.



Did we match?  
 The short answer is yes we did.

The graphs show that both the Human and the NLP matched on the majority of the codes. The graphs also show that the NLP coded comments more positively than the Human did. The paper comments matched more closely than the teacher comments but the coding of the teacher comments tended to be more positive in comparison.



### What does all this mean?

Again, the short answer is that the computer can do the same job as the human. This means the written feedback can be analysed and reported on in future allowing any problem areas to be identified and changes made where required.

It is true what they say computers really are replacing humans, but in this instance, it is for the better.



THE UNIVERSITY OF  
**WAIKATO**  
*Te Whare Wānanga o Waikato*

# Equitable Status and Opportunities for Disabled Students in Work-Integrated Practice Across the University of Waikato

Supervisors: Dr Sandy Muller and Dr Anthony Richardson  
Researcher: Nikita (Nikki) Van Dijk

## Introduction

Work Integrated Learning (WIL) has become an integral part of the undergraduate programmes at the University of Waikato. It has many benefits, with its purpose being to better prepare an individual for their intended career, working environment and contributing to the community. However, the experiences of disabled students at the University of Waikato regarding WIL is not well understood. This project is attempting to better understand the opportunities of disabled students relating to WIL, the barriers they experience and what can be done to create better opportunities and support processes for disabled students in regard to WIL placements and projects.

## Method

In order to gather all of the data possible regarding this project, two surveys were created and sent out via email in order to quickly and effectively reach our intended target groups. The first survey was sent to disabled students at the university, whether they are disabled undergraduate students who are completing WIL or postgraduate students who have completed WIL at the University of Waikato. The purpose of this survey is to find out whether disabled students gravitated to projects or placements, what barriers they experienced, and what they recommended could be done to give better opportunities to disabled students at the University of Waikato. The other survey was sent out to staff involved with WIL at the University of Waikato. The purpose of this survey was to see how staff felt about the opportunities and access of WIL courses at the University, and whether they could be improved for disabled students. The survey could also be found on posters placed around campus.

## Acknowledgements

Thank you to Dr Sandy Muller and Dr Anthony Richardson, who both not only went above and beyond in facilitating and supervising this project, but continue to as data is gathered to better address this issue at the University of Waikato. Without their ongoing support and guidance, this project would not be as successful or full of opportunities as it is. Thank you

## What Research Indicates

While there is no research regarding disabled students and WIL at the University of Waikato - or anywhere in New Zealand for that matter - there is some research overseas in places such as the United Kingdom, Canada and Australia that could be applicable to the University of Waikato. Research indicates that ensuring inclusive education and experiences at a tertiary level is a challenge internationally. Research from Australia suggests that opportunities and barriers are both best analysed and understood from a cultural, social and financial perspective (Andrew, 2020). While other research indicates that societal views on disability and accessibility of placement locations are barriers that need to be addressed (Boye, 2022). Overall, however, there is a lack of research into the opportunities, barriers and experiences of disabled students regarding Work Integrated Learning and the goal is that the results of this research will help to confirm whether studies such as Andrew's and Boye's are applicable or accurate.

## Discussion and Outcomes

While the results and the outcome of the project is not yet known, the project has been an interesting one to say the least. It was both interesting and surprising reviewing the literature regarding this topic, as it was a surprise to see how little there was regarding disability and WIL and seeing how disabled students are protected academically internationally. It was interesting and saddening to see that ensuring inclusive education and opportunities for disabled students is an issue internationally at a tertiary level, and quite unnerving to see that there are many places - such as with WIL - where there is a gap in support for disabled students. However, this creates an opening for research into this area, and into what can be done to give better opportunities and support measures to disabled students regarding WIL not only at the University of Waikato, but nationally too.



# Te Kura Toi Tangata- Division of Education



# Insights into working alongside young writers

## Preservice teachers reflect on their experiences with individual young writers in Aotearoa New Zealand



Supervisor: Jessica Rubin Author: Jenny Cross

### Background

Teaching writing has a significant role in preparing young students for life-long learning. Despite extensive literature on the methods for teaching writing and many articles on the experiences and expectations of preservice teachers to teach writing, there are few examples of preservice teachers working with individual young writers to deepen their understanding of how a piece of writing may be motivated, composed and intended through the individual's belief of themselves as a writer and in their own potential. This research project is based in New Zealand and shares the lived experiences of preservice teachers working with individual young writers as part of their teacher education.

### Method

Data came from 47 post-graduate student assignments and post-module student questionnaires.

**Iterative coding** that uses themes that present themselves as we analyse the data.

**Reflexive thematic analysis** naturally reflects characteristics of Jessica and I's own thinking and communication styles yet encouragingly allows us to be open-minded and subjective as we co-construct the dominant themes that emerge from the process of analysing the data.

### Acknowledgements

To my supervisor Jessica Rubin, I sincerely appreciate the opportunity to collaborate on this mahi. I extend my gratitude to the University of Waikato Summer Research Scholarship program for this valuable enrichment.

### Finding:

The assignment was structured so that the preservice teachers were set up for pedagogically "sitting alongside" a young writer and also that they had opportunities to "glance sideways" at their focal student's writing in progress.

### Implication:

Teacher education experiences are opportunities to encounter interwoven pedagogy and relationship building in a 'real-life' classroom environment. The participants acknowledged the authenticity and quality connection this structure afforded them.

### Finding:

That course readings and class experiences supported the preservice teachers to position young writers appreciatively to effectively engage students with their individual successes and encourage quality progressions and see this as part of the complex intellectual work of being a teacher of young writers.

### Implication:

Many participants described how the coursework and readings supported them to accelerate away from their default method of assessing the mechanics of writing to informed realisations of what is working well for the writer as an individual that enabled them to provide encouraging, informed recommendations.

### Finding:

The significance of being with young writers during their composing of a piece of writing rather than assessing a "finished composition" offered insights into their methods and thinking.

### Implication:

Participants described their jubilation of being able to offer high quality 'in the moment' instruction to the student as they discussed or simply witnessed the planning and composing.

### Conclusion

Structuring preservice teacher education with opportunities to 'work alongside' young learners provides intensive quality experiences for preservice teachers to authentically reflect and review their current and future pedagogy in writing that is substantiated by their supporting coursework and relevant literature. This leads to preservice teachers understanding the importance of appreciatively attending to each young writer's own merits and progressions.

### References

- Braun, V., & Clarke, V. (2021). One size fits all? What counts as quality practice in (reflexive) thematic analysis? *Qualitative Research in Psychology*, 18(3), 328–352.
- Collier, D. R. (2016). Glancing sideways at young writers becoming. In T. Cremin & T. Locke (Eds.), *Writer identity and the teaching and learning of writing* (1st ed., pp. 98-114).
- Moore, R. A. (2000). Preservice teachers explore their conceptions of the writing process with young pen pals. *Literacy Research and Instruction*, 40(1), 17–33



# THE TRANSITION TO SECONDARY SCHOOL

Kāhui Ako teachers and school leaders' insights.

## BACKGROUND

The transition to secondary school is a challenging experience for students. It has been proven that there is a negative relationship between poorly executed transitions and student well-being and academic achievement in Aotearoa (Ministry of Education, 2010). In Aotearoa, Kāhui Ako (Communities of Learning) aim to raise student achievement through taking collective responsibility for student success.

## PURPOSE FOR THE STUDY

In response to this, this study explores how collaboration between Year 8 and Year 9 school leaders foster a positive transition to secondary school for students.

## BARRIERS

There are numerous barriers that impact the success of students' transitions. Children, parents and teachers face stress through having to adapt in the transition (Rens et al., 2018).



## Profile of a positive transition

Building relationships and having strong across school collaboration is key to a successful transition. Ensuring that students' relevant information is being passed on from the Year 8 school is crucial.

Interactions with family



Familiarity with the environment



Knowledge of pedagogies



## METHOD

Interviews were conducted with the school leaders either face to face, or by Zoom. Interviews ranged from 25-50 minutes in length.

## FINDINGS

- Participating schools identified that collaboration is key to a successful transition.
- All high schools shared that open days were their key method of interacting with incoming Year 9 whānau. It was at these events parents heard about the kaupapa of the school, attendance expectations and be introduced to key people.
- Familiarity with the school environment is crucial to alleviate anxiety in students.
- All teachers shared the importance of having an understanding of the pedagogy of each school.

## RECOMMENDATIONS

Suggestions from school leaders on ways to enhance the transition experience for students were:

- Better communication between school leaders, students and whanau.
- Year 9 teachers attend a Year 8 class and vice versa.
- More focus on well-being and relationships.
- One-on-one interviews with students and teachers prior to starting Year 9.

References:

Ministry of Education. (2010). Annual report. Crown.

Rens, M & Haelermans, C & Groot, W & Maassenvandenbrink, H. (2018). Facilitating a Successful Transition to Secondary School: (How) Does it Work? A Systematic Literature Review.



Dr Emma Cunningham and Samantha Dearnley

Te Kura Toi Tangata School of Education, University of Waikato, New Zealand



## Introduction

This project looked at possibilities of re-imagining initial teacher education (ITE) to support student teachers in early childhood (ECE) to view themselves, their work and subjectivity in relation to and 'interaction' with a more-than-human world. Neoliberal and neo-colonial discourses shape ITE in Aotearoa. As a result, teacher preparation is often narrowed to a seemingly linear and standardised process with predicted outcomes for all students. Moreover, ITE programmes are expected to produce student-teachers equipped with the skills, knowledge, and practice; hence, they are 'ready' to demonstrate 'core teaching skills' when they start their first teaching role. However, one may ask, what may happen if we start thinking of ITE and teacher preparation as a process of 'teacher becomings' interwoven in innumerable configurations of places, times, matters and meanings? To address this question, the project utilised critical feminism posthumanism, new materialism and critical pedagogies (Barad, 2007; Braidotti, 2022; Haraway, 2016) to look at ITE and teacher work within an intersectional and more-than-human world.

## Methodology

Advanced literature research for critical posthuman feminist and new-material theories

Qualitative analysis of data sets gathered from ITE papers and student assignments using NVivo

Critical review of selected literature with NVivo Software

Comparative analysis of key concepts from the advanced literature and key findings from the data sets

## Findings

The initial analysis of ITE papers and student assignments illustrated that neoliberal and neo-colonial discourses shaped student teachers' views of themselves, their teaching practice and the purpose of ECE. With the ITE regulations focused on developing 'core competencies' necessary for students to be 'ready' to 'teach', it seems less effort was put into critical engagement with broader socio-economic and political issues shaping professional identities and practices in ECE. Findings also alluded that issues of superdiversity, intersectionality, climate change, queerness, gender equality, culture and non-human in ECE and broader education contexts were looked to find a solution and ensure individual 'effective practice' rather than challenging a status quo in ECE through collective activism.



Diagram 1. Human, non-human, and more-than-human entities, issues and matters.

## References

- Barad, K. (2007). Meeting the universe halfway: Quantum physics and the entanglement of matter and meaning. Duke University Press.
- Braidotti, R. (2022). Posthuman feminism. Polity.
- Haraway, D. J. (2016). Staying with the trouble: Making kin in the Chthulucene. Duke University Press.

## Discussion

Neoliberal and neo-colonial discourses and human-centred epistemologies favoured standardised approaches and measurable learning outcomes in ITE. Centred on the human, their agency, learning, development, and advancement, ITE seemed to give little attention to problematising the concept of the 'human', "Man" as "the measure of all things" (Braidotti, 2022). This project argues for making sense of a collective 'we' in ITE, a sense of living in and with a more-than-human world. Drawing on the data analysis and literature review, it advocates for ITE that will support student-teachers to critically examine intra-actions among and between human, non-human and more-than-human entities and take them into account in their teaching practice (Diagram 1, Braidotti, 2022). Re-imagining ITE programs through a posthuman lens could offer student-teachers a critical framework to explore the interconnectedness of the human, places, matters, times, and thoughts and resist neoliberal and neo-colonial discourses in teaching practice.

## Conclusion

By taking a critical feminist, new-materialist and posthumanist lens (Barad, 2007; Braidotti, 2022; Haraway, 2016) at the literature and data gathered in an ITE programme, this project addressed and provoked us to ask:

What would such ITE, and ECE, feel and look like in a bicultural democratic Aotearoa New Zealand society? What differences could it make?

If/How can we re-imagine ITE as 'a difference-rich,' 'entangled,' 'intra-active,' and jointly produced ever-shifting process between and among human, non-human, and more-than-human 'actants'?

## Acknowledgments

Special thanks to Dr. Olivera Kamenarac, The University of Waikato, and to the Summer Research Scholarship Programme granting this opportunity to develop research skills and further knowledge.

# Updating understandings of distance doctoral students



THE UNIVERSITY OF  
**WAIKATO**  
*Te Whare Wānanga o Waikato*

Emma Jones - BMus student

Supervisor: Katrina McChesney

Wider research team: Jamie Burford (Warwick University, United Kingdom), Liezel Frick (Stellenbosch University, South Africa), and Tseen Khoo (La Trobe University, Australia).

In a digitally saturated, globally connected, post-pandemic world, old assumptions about "distance" doctoral students need refreshing. In my summer project, I analysed data from an international survey of over 500 doctoral students who shared their diverse experiences of studying away from campus.

The results from the 521 participants show that the cohort of distance doctoral students came from a wide range of; ages, continents, subject areas, and reason/s for studying by distance.

- The participants ages at the start of their doctorate ranged from 21 to 71 years old with a mode of 28 years old.

The "distance" experiences for these doctoral students most commonly consisted of; living far away from their institution or lived close to their institution but chose to complete some/all of it at home.

Furthermore, the universities were located in a different country for only 10% of respondents and it was also common that participants would have preferred studying on campus but were unable to (for various reasons).

Students often had a lot going on in their personal lives with family, work, health etc. as:

- Life events commonly occurred during the participants' distance doctoral studies. These had a maximum of 15 events and a mean of 3.84 events.
- COVID-19 also impacted respondents in up to 11 different ways and a mean of 3.3 impacts.

This meant that for a lot of distance students, completing their doctorate without the restrictions of being required on campus, was a major benefit and enabler to their studies.



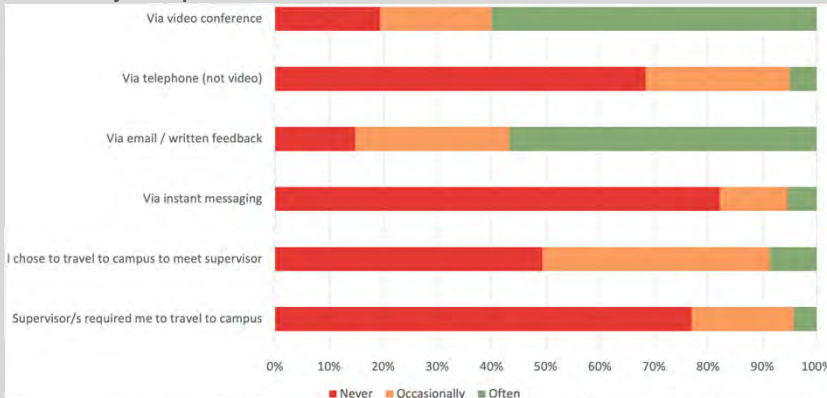
## Results & Findings

### What were your reason/s for undertaking your doctorate by Distance?



The most common response was that participants undertook their doctorate by distance because they didn't live near their campus. However, this also means that there were a lot of students who actually did live near their campus but chose or needed to study by distance for a variety of reasons. Therefore, distance enrolment enabled these students to; have greater flexibility, have more time to continue other responsibilities, and even save money, as they were not being forced to travel or move closer to campus for their studies.

### How was your supervision conducted?



It was surprising that telephone supervision was only used about 30% and instant messaging was used less than 20% of the time. This suggests distance learners may not have as much access to their supervisors when they require answers to quick/small questions compared to on-campus students, who are often able to see their supervisors around campus and/or pop into their office when they require answers.

## Conclusion

Distance doctoral students are a very diverse cohort, ranging in; ages, genders, reasons for undertaking their doctorate by distance, continents, supervision approaches, and engagement in other activities to assist their studies. The results from this survey are intended to break the common stereotypes and therefore, assumptions of distance learning in how we design programmes, supervision, professional learning etc. This is because distance doesn't just look one way and doesn't just encompass one type of student. "Distance" learning acts as an enabler for doctoral students to access doctoral study and therefore, should no longer be positioned as 'second best, or as an anomaly.

## Acknowledgements

I would like to express my gratitude to the University of Waikato for providing this Summer Research Scholarship opportunity. I would also like to thank Katrina McChesney for supervising this project and providing wonderful support.

## References

Albion, P. R., & Erwee, R. (2011). Preparing for doctoral supervision at a distance: Lessons from experience. *Society for Information Technology & Teacher Education (SITE)*. [https://www.researchgate.net/publication/230008104\\_Preparing\\_for\\_doctoral\\_supervision\\_at\\_a\\_distance\\_Lessons\\_from\\_experience](https://www.researchgate.net/publication/230008104_Preparing_for_doctoral_supervision_at_a_distance_Lessons_from_experience)

## Introduction

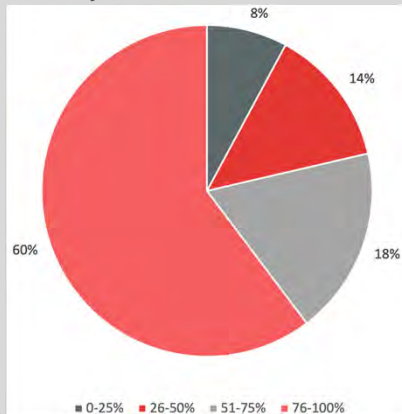
Distance education has brought growth in the number of students at doctoral level but also new challenges that require preparation from universities (Albion & Erwee, 2011). In the past, there has been limited research into the experiences of doctoral researchers studying by distance. This is inequitable and outdated, especially considering the impact of the pandemic on mobility and hybrid ways of working in a range of contexts.

The impact of COVID-19 has had positive effects by increasing non-voluntary distance education (including at doctoral level). COVID-19 has also created changes in the normative ways of studying by including; off-campus, online, hybrid, work from home, flexible, and cross-national modes of study. Therefore, the increased access to distance modes of education is important from an equity and moral perspective as it allows for greater diversity and inclusion for students in higher education. "Distance" acts as an enabler by making doctoral education accessible to those who may otherwise miss out.

## Method

- Online survey in 2022 with ethical approval of four partner institutions.
- 521 responses across 42 countries in Australasia/Pacific (40%), Europe (31%), North America (15%), Africa (7%), Asia/Middle East (7%).
- Participants were: female (82%), male (16%), and non-binary (2%) and for 54% of respondents, their doctorate was their first time studying via distance.
- Participants undertaking doctoral study in: Education (32%), Sciences (20%), Social sciences (21%), Arts and humanities (18%), Business and management (4%), and Engineering, design and technology (5%).
- Distance conceptualised broadly including: geographic distance, online study/enrolment, remote fieldwork, and hybrid/working from home.

### What proportion of your doctorate was conducted OFF campus?



For over 3/4 of the respondents, 50-100% of their doctorate was conducted off campus. This is significant as it allowed students flexibility to continue; work, parenting / caring, community and cultural obligations, travel, etc.

# Impact of education on Māori

## 01 Background

Dr. Tocker examined the impact of effective schooling, role models as well as cultural experiences, from the 1950's to the year 2000, on students who attended a rural primary school.

## 02 My role

- Transcribe interviews
- Pull out common themes from transcripts
- Examine relevant methodology

## 03 Method

- Qualitative data collected from interviews .
- Kaupapa Māori methodology utilised in interviews.
- Pūrākau methodology when analysing data from interviews

## 04 Results

Education up to the 1980's focused on assimilating Māori to western ways. Māori language and culture not seen as important in the learning. From the 1980's Māori language revitalization resulted in changes in teaching content and a focus on Māori language and connections to marae, hapū and iwi.

## 05 Conclusion

In the 1950's the school was an English language school. Today it is known as a Kura-ā-Iwi in which the curriculum subjects as well as the language, culture and traditions of Ngāti Tūwharetoa are practised. Māori language, knowledge and tikanga strengthen the identity of students and enables them to move comfortably in both the Māori world and the Western world.

### References

- Hoskins, TK. & Jones, A. (2017). Critical conversations in kaupapa Māori. Huia.
- Lee, J. (2009). Decolonising Māori narratives: Pūrākau as a method. Mai review, 2 (3). <http://www.review.mai.ac.nz>
- Smith, L.T. (2012). Decolonizing methodologies: Research and indigenous peoples. Zed Books

## Ngāpuke Māori School

1950-1970

English language      Physical punishment: the cane  
Social studies      Farming community  
Maths      Health checks:  
Sports      hanky, nails,  
Religion      head lice  
European History      No marae connection  
Some Māori songs  
No Māori language



## Ngāpuke Kura-ā-iwi

1980-2000

Ngāti Tūwharetoa: reo, mātauranga

Karanga/ Whaikōrero

Whanaungatanga

Tuakiritanga

Manaakitanga

Aroha

Whakapapa

Hākinakina

Tuakana/teina



Marae: Ringawera, paepae, school prizegiving, haka, waiata tautoko  
Kapa haka wānanga/competitions  
Iwi/ hapū tikanga incorporated into curriculum



THE UNIVERSITY OF  
**WAIKATO**  
*Te Whare Wānanga o Waikato*

Acknowledgements The University of Waikato  
Summer research programme  
Designed by Kuini Mareroa  
Supervised by Dr. Kīmai Tocker



# ANALYSING DIVERSITY in Aotearoa New Zealand Picturebooks

Published in 2021/22

## INTRODUCTION

### Why did we do this?

It's really important for all children to see themselves in books to create a sense of belonging and identity, as well as establishing an interest in reading.

We've read about diversity in children's books from other countries<sup>[1], [2]</sup> but there wasn't any information about diversity in Aotearoa New Zealand picturebooks.

*We wanted to know more!*



## METHOD

### How did we do this research?

The research team collected all the picturebooks published in Aotearoa New Zealand between 1 August 2021 and 31 July 2022. We analysed the illustrations and writing to identify various ethnicities, gender, family composition, disability and languages used.

*It was complicated but lots of fun!*



## INTERM FINDINGS

### What have we found so far?

So far we've analysed the ethnicity of the primary character and we've found some interesting information.

- The majority of characters (44%) were non-human (animals, diggers, a mermaid).
- The number of characters of colour (Māori, mid-tone skin, brown skin, Pacific) far exceeded the number of white characters (37% c.f. 19%).



## DISCUSSION

### Why is what we've found interesting?

New Zealand's statistics for non-human characters are similar to those found in overseas research, but the number of characters of colour is very different.

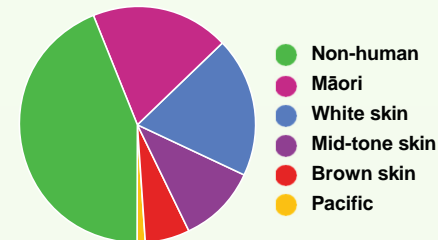
For example, the Centre for Literacy in Primary Education study of British children's literature found 20% of picturebooks included characters of colour which included minority ethnicities<sup>[3]</sup>.

In comparison, **37%** of New Zealand picturebooks featured characters of colour.



## Primary Character Ethnicity

### Aotearoa NZ Picturebooks 2021/2022



44% Non-human  
19% Māori  
19% White skin  
11% Mid-tone skin  
6% Brown skin  
1% Pacific



Data based on picturebooks published in Aotearoa New Zealand August 2021 – July 2022.

## REFERENCES

- 1 Adam, H., & Barratt-Pugh, C. (2020). The challenge of monoculturalism: what books are educators sharing with children and what messages do they send? *The Australian Educational Researcher*. <https://doi.org/10.1007/s13384-019-00375-7>
  - 2 Booth, E., & Lim, R. (2022). The Picture of Privilege: Examining the Lack of Diverse Characters in 2018 Australian Children's Picture Books. *Jeunesse: Young People, Texts, Cultures*, 14(1), 65–83. <https://doi.org/10.3138/jeunesse-14.1.0>
  - 3 Centre for Literacy in Primary Education. (2022). REFLECTING REALITIES: Survey of Ethnic Representation within UK Children's Literature 2017-2021. [https://clpe.org.uk/system/files/2022-1/CLPE%20Reflecting%20Reality%202022%20WEB\\_0.pdf](https://clpe.org.uk/system/files/2022-1/CLPE%20Reflecting%20Reality%202022%20WEB_0.pdf)
- All illustrations of children are courtesy of brgfx from Freepik.com Speech bubbles courtesy of freepik from Freepik.com



# A Model of Teacher Development Through Digital Stories

The University of Waikato, Department of Education, Summer Intern: Zaida Moffat, Internship Supervisor: Hazel Woodhouse

**Acknowledgement:** Thank you to my supervisor Hazel Woodhouse from the Department of Education, Waikato University, for the privilege of the collaborative work experience on this project. I would also like to thank the student teachers that contributed their digital stories to this research project.

This poster presents a summary of research findings from this Summer Internship Scholarship Project, *Evidencing teacher Development Through Digital Stories*, as a continuation of PhD research by Hazel Woodhouse. The aim of this research project is to explore the use of digital stories (DS) (i) as a means of personal introduction to connect with new colleagues, additionally, (ii) to be developed as a tool to assist reflection and critical thinking for the professional development of graduate teachers in Aotearoa, New Zealand.

These tasks were achieved with the transcription and analysis of a DS completed by first year teaching students, the research and construction of an annotated bibliography, and the production of a personal DS of this internship experience. According to recent studies, the significance in the construction of a personal DS for the purpose of understanding the process “contributes to both pedagogical content knowledge and learning, and teaching experience of the stakeholders in those studies” (Çetin, 2021, para. 1). This process enables the opportunity to solidify learning by writing, synthesizing, evaluating, and creating information content.

The DS narratives created by first year teaching students from The University of Waikato, depict a visual journey of their hometown, family, friends, and pedagogical experience indicating a strong connection with cultural identity blended with an ownership of personal values and life experience. The use of personal statements that reflect career aspirations and personal goals through professional development are evident and promote the presence of empowerment through self-presentation that is imperative in the role and development of teacher presence. According to a study by Kim et al. (2021, para. 10) the observation of the function of DS gives insight into the representation of self-expression, intrapersonal presentation, and compositional perspective that the story illustrates through the visual media. These semiotic elements are considered sociocultural artifacts that create context into understanding the individual’s ethnicity, values, beliefs, gender, views, and perspective as part of their unique personal expression.

#### References:

Çetin, E. (2021). Digital storytelling in teacher education and its effect on the digital literacy of pre-service teachers. *Thinking Skills and Creativity*, 39, 100760–. <https://doi.org/10.1016/j.tsc.2020.100760>

Kim, D., Long, Y., Zhao, Y., Zhou, S., & Alexander, J. (2021). Teacher professional identity development through digital stories. *Computers and Education*, 162, 104040–. <https://doi.org/10.1016/j.compedu.2020.104040>



**Presentation:** Exploration of personal voice and connection with an audience

- Cultural inclusion and responsiveness
- Creative expression
- Potential integration of symbolic objects
- Consideration of intended audience range and ability

**Content:** Planning and research of the topic with purpose and context

- Professional development
- Information gathering with research credibility
- Critical thought process
- Goal setting/ planning and self-evaluation

**Delivery:** Technical construction of the visual presentation, design, and production

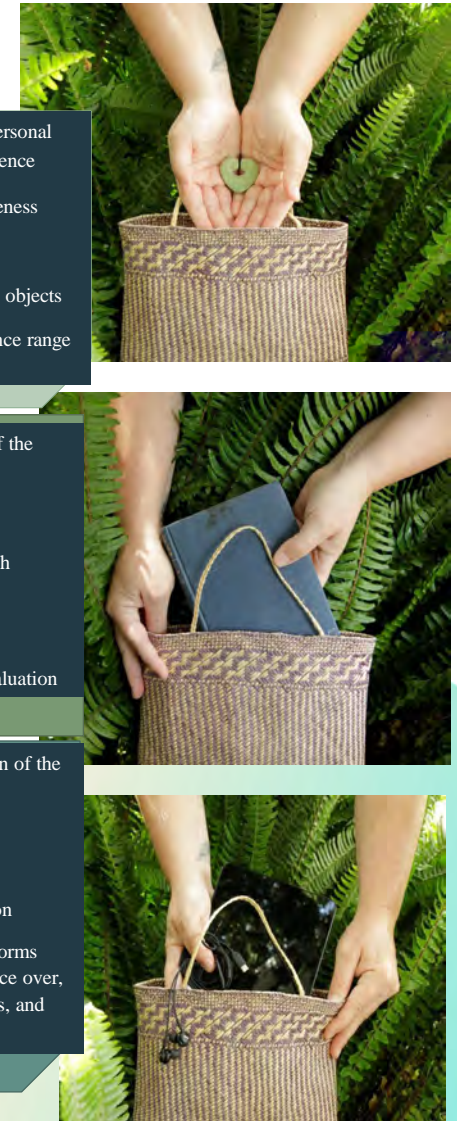
- Digital competence
- Exploration into media production
- Use of customized learning platforms (like SELI), video, sound bite, voice over, still photographic images, graphics, and text

**Results:** In conclusion of this research project, a model is presented that identifies three key elements that have emerged for consideration through a literature review and the analysis of personal stories, that are recognized as fundamental stages in the construction of a personalized; education focused, DS. These key elements are **Presentation, Content, and Delivery.**

The model provided illustrates photographs depicting the symbolism of personal cultural artifacts pertaining to the elements of the DS making process, held by a kete of knowledge that represents a vessel by which knowledge and tools are held for future access.

- An image from this photographic series will be submitted for publication as part of the Wilf Malcolm Institute of Educational Research (WMIER) Images of Research for 2023.

Please view my digital story using this QR link, which contains a recommended reference list of digital storytelling in education





# Narrative therapists address substance (mis)use in Aotearoa: Stories from the field

Thank you to research participants Atarangi, Hahana and Peter for your stories of narrative therapy work in NZ addictions services

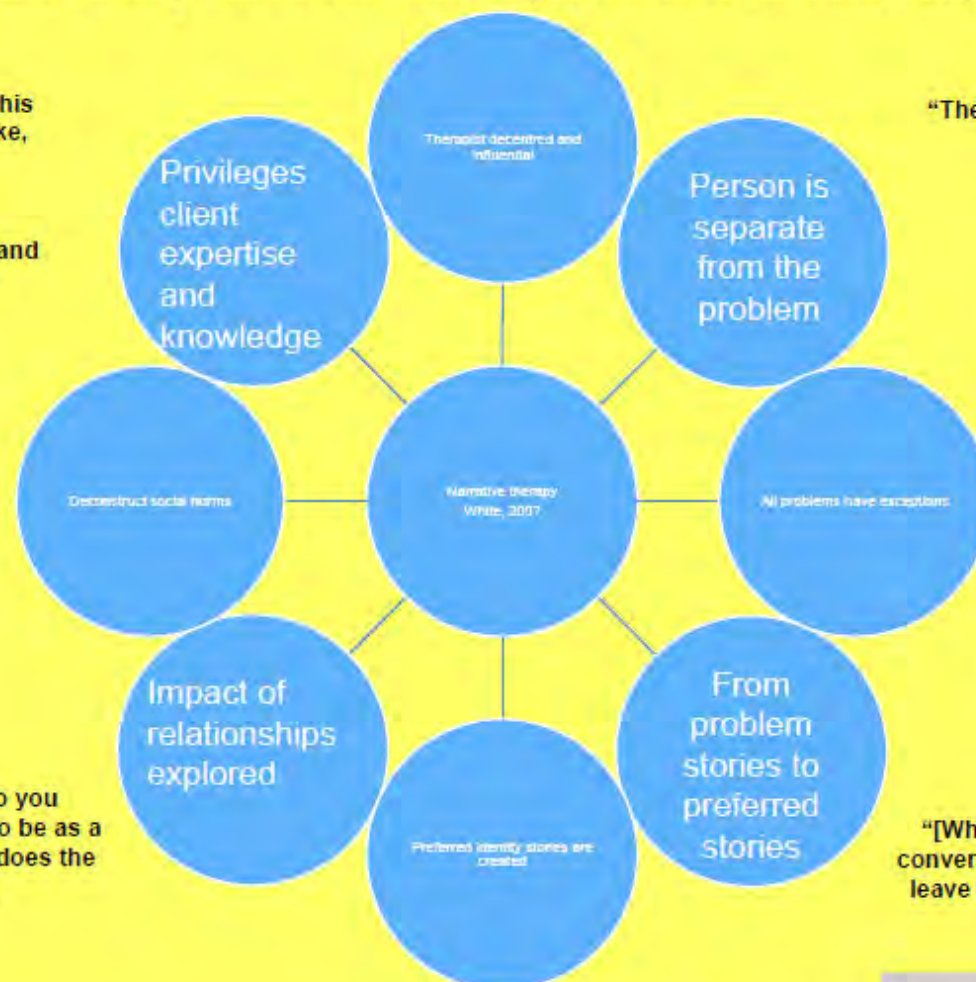
"I'm negotiating what he needs, what he thinks his relationship with substance misuse has been like, and what he needs to happen next" (Atarangi)

"The person is the expert author of their life ... and the person knows best for themselves" (Peter)

"The society expectation of how we do things and how being a man looks like. You know to be a man and grow up you have to drink" (Hahana)

"Ingesting a substance modifies both the substance and the person, but it does it in all sorts of ways" (Peter)

"It's people's identity that we bring out. 'How do you want to be as a mother?' Or 'how do you want to be as a father?' Or 'how do you want to be?' And 'how does the substance stand in the way of that?'" (Hahana)



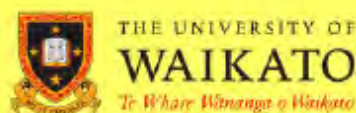
"The naïve inquirer is always a healthier position and is appreciated by the Whaiora" (Atarangi)

"The majority of my approach is relational, what lies beneath, and you [Whaiora] are not the problem" (Atarangi)

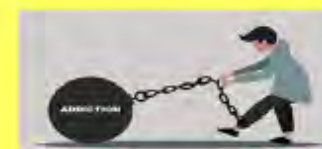
"I don't want to see clients kind of being identified by the substance.. yeah, they have a problematic relationship with a substance" (Hahana)

"We're looking for possibilities, not 'these are the things that you've done wrong'" (Atarangi)

"[Whaiora] come to me to talk about problems...we have conversations, and they go in various directions. And they leave thinking about things in a different way...New ideas and new possibilities" (Peter)



Researchers: Dr Wendy Talbot and Tina Phillips. Poster created by Tina Phillips  
Te Kura Toi Tangata School of Education, University of Waikato, New Zealand





# EMBEDDING COMPUTATIONAL THINKING IN PRIMARY SCHOOL TECHNOLOGY PRACTICE



## RESEARCH AIM

The aim of this project is to teach students conceptual understanding of computational thinking and develop these skills within an authentic context that incorporates kaupapa Māori in a meaningful and inclusive way.

## WHAT IS CONCEPTUAL THINKING FOR DIGITAL TECHNOLOGY?

As defined by the New Zealand Curriculum (NZC), computational thinking for digital technologies "enables students to express problems and formulate solutions in ways that means a computer... can be used to solve them" (Ministry of Education, 2007). The taurira who are involved in this project fit under Level One achievement objectives and the focus for their learning has been to help them achieve Progress Outcome 1 (PO1). PO1 requires taurira to use decomposition skills to break down data, abstraction to organise the data and algorithmic thinking to create a step-by-step sequence of instructions. They will also need to show simple debugging skills by identifying errors in their sequence prior to using it.

## WHAT IS KAUPAPA MĀORI?

Kaupapa is defined as a topic, policy, or initiative. The use of kaupapa Māori in this context relates to recognising and utilizing Māori initiatives and policy (tikanga) to guide kaiako in preparing the digital technology unit. Incorporating kaupapa Māori in an authentic context requires embedding Māori values and principles in the digital technology lessons. It goes beyond adding kapa or using simple phrases, but rather incorporates all different types of matauranga Māori. This includes but is not limited to giving the students a safe place to express their identity and activating their prior knowledge and experiences.

## NGARUAWAHIA PRIMARY SCHOOL

This research project was completed at and with assistance from Ngāruawahia Primary School. It is a full primary, English medium school. Taurira from Rooms 1 and 2 participated in the study ranging from year 0/1 (5-7 year olds). A high percentage of the taurira identify as Māori from Tainui.

## BEE BOT

Our primary digital resource used while teaching taurira computational thinking was a Bee Bot. Bee Bots have input buttons on their back that allows the user to give them movement instructions. The Bee Bot can move forward and backward, rotate 90° left or right, a clear function and a go function. In this project, taurira would enter their coded sequence into the Bee Bot, place it on a large map and watch to see if can navigate to all the relevant objectives.

## RESEARCH DESIGN AND FINDINGS

After extensive interviews with the participating kaiako and assessing the current computational knowledge of the taurira, the kaiako created a digital technology unit with the researchers in support. The main resources the taurira used were a 5x5 coordinate map, pens, a sequence template printout, and a Bee Bot. The map had different locations on it and the taurira had to write a step-by-step sequence of instructions. The sequence would then be entered into a Bee Bot and it would move according to the taurira's programme.

## COMPUTATIONAL THINKING SKILLS

- Kaiako used storytelling to present taurira with their tasks objectives
- Taurira would then need to decide which locations on the grid they needed to go to (decomposition)
- Taurira would write their sequence out using clear, precise, step-by-step instructions (abstraction, algorithmic thinking)
- Taurira would test their sequence using a manipulative (simple debugging)
- Once confident that the sequence was correct, the taurira would show the kaiako and enter their programme into the Bee Bot

## KAUPAPA MĀORI INCLUSIONS

- Context of the story used elements of taurira's lived experiences
- Te reo Māori was used throughout the learning
- Tuakana/Teina pairings used to deepen students understanding through collaboration
- Culturally safe spaces were created so that students could freely express their identity
- Whakaraupapa (to sequence, arrange in order) was emphasised to ensure taurira were sequencing things in a logical order
- Ahunga (direction, bearing, orientation) skills were taught through multiple integrated curricula (drama, visual art and dance, english, math)

## REFERENCES

Bell, T. (2016). Māori and the Digital Technology Strategy and Secondary Computing Education Guidelines 2016. Wellington, NZ: Education. <https://www.education.govt.nz/secondary-computing-education/>

Booth, M., Lewinsohn, D., & Linn, E. (2017). Cultural responsiveness for responsive pedagogy: A critical case study. *Journal of Research in Education*, 18(1), 1-10. <https://doi.org/10.1177/0022027216680001>

Devine, C., Bell, T., & Teare, S. (2019). *What's Next? Beyond the Digital Technology Strategy and Secondary Computing Education Guidelines to Digital Literacy and Digital Citizenship*. Wellington, NZ: Education. <https://www.education.govt.nz/secondary-computing-education/>

Irons, J., & Hartnett, M. (2020). Computational thinking in primary classrooms in New Zealand. *Journal of Open, Flexible and Distance Learning*, 24(2), 40-49.

Leonard, J., Shaw, A., Goshok, S., Mitchell, M., Stevens, D. S., Doherty, T. A., & O'Connell, S. (2018). *Using robotics and game design to engage children's self-efficacy, attention, and Computational Thinking skills*. *Journal of Science Education and Technology*, 27(6), 660-676. <https://doi.org/10.1007/s10992-018-9282-2>

Ministry of Education. (2007). *The New Zealand Curriculum*.

## DISCUSSION

Teaching young tamariki computational thinking needs to become a priority as the world progress to a place where digital technology permeates our daily lives (Bell, 2016). Much like reading, writing or doing math, computational thinking is a skill that needs to be taught. The aim of this project was to teach Māori students computational thinking by embedding kaupapa Māori practices within it as a way to foster an authentic learning context (Leonard et al., 2018). During the course of the project, researchers observed the computational thought processes used by the taurira and their execution of their sequences with the Bee Bot. It was determined that taurira had succeeded in meeting the criteria set out by PO1 in the NZC.



SCAN THIS CODE  
to view our  
taurira in action!

One of the main factors that lead to the success of this project was the kaiako. They were confident and competent around digital technology and understood the concepts of computational thinking (Irons & Hartnett, 2020). They were able to use the tools and resources provided to enrich the learning environment around the taurira (Duncan et al., 2014). They also made the integration of te ao Māori appear seamless in the learning. It was clear that they knew their learners and created a safe place for taurira to express themselves and their identity while learning (Berryman et al., 2018).

## WHAT'S NEXT?

### DIGITAL APP.

Taking what was being done with pen and paper and using it on a tablet. This will help push the students into higher-order thinking and allow for the scaling of more complex algorithms.

### LOCAL KAUPAPA MĀORI

Extending the taurira's learning to incorporate the local iwi and community.

- Context of the future unit will involve Ngāruawahia's food pits, Tainui waka journey down the Waikato and naming all the different taniwha known in the area.

### TUAKANA/TEINA FOCUS

Due to the effectiveness of this pairing in the classroom, considerations are being made for designing the next unit around this Māori learning principle.

- Extend the learning to year 5-6 taurira
- Help them to become proficient in computational thinking
- Take the year 5-6 taurira and set them as tuakana for a year 1-3 teina





# Growing up Arty

## How place and identity shape each other

Sharna Steer, Supervised by Bronya Dean and Lynda Johnston  
*School of Education, University of Waikato, New Zealand*

### The Project

'Growing up Arty' investigates how place and identities construct each other. Specifically, we look at the nature of young people's experiences at Tauranga's community performing arts centre, Baycourt. This project's goal is to learn how Baycourt shapes young people's musical identities. This is a timely project as Tauranga City Council is developing a new Arts Precinct for the city.

### Methodology

We surveyed and interviewed adults who had attended Baycourt as a young person. We received 76 responses and have conducted one interview, to date.

My analysis of the survey data revealed several themes that portrayed the importance of Baycourt as a space of expression and how it helped shape identity.

### Themes from data

**Belonging**  
(Stewart Rose & Countryman, 2021)

**Emotional Response**  
(Stewart Rose & Countryman, 2021)

**Family Support**  
(Pitts, 2009)

**Sense of Achievement**  
(Stewart Rose & Countryman, 2021)

**Importance of peers**  
(O'Neill, 2017)



Art by Gian Naballin

### References

- O'Neill, S. A. (2017). Young People's Musical Lives: Learning Ecologies, Identities, and Connectedness. In R. MacDonald, D. J. Hargreaves, & D. Miell (Eds.), *Handbook of Musical Identities* (p. 0). Oxford University Press. <https://doi.org/10.1093/acprof:oso/9780199679485.003.0005>
- Pitts, S. (2009). Roots and routes in adult musical participation: Investigating the impact of home and school on lifelong musical interest and involvement. *British Journal of Music Education*, 26(3), 241–256. <https://doi.org/10.1017/S0265051709990088>
- Stewart Rose, L., & Countryman, J. (2021). When youth musicking is play. *Research Studies in Music Education*, 43(3), 465–480. <https://doi.org/10.1177/1321103X20936380>

### Participant Survey Comments

"Sense of achievement playing in a big theatre and dressing up"

"...it was a chance to spend time with a common group of like-minded kids..."

"Knowing my family were watching me in the audience"

"It felt like our own place and only we could know it."

"[I watched] my first ever show. It was awe inspiring..."

### Discussion

These themes and responses are important because they give us insights into how Baycourt was able to provide a space where young people expressed and developed their musical identities.

### Conclusion

This project is on-going and early evidence suggests that young people's musical spaces are vital to the creation of their musical identities. We will share our findings with the Tauranga City Council to assist them with the development of inclusive and child-friendly art and performance spaces in the city.





# Te Pua Wānanga ki te Ao – Faculty of Māori and Indigenous Studies

# Te Paa Harakeke

## 1. Background

The purpose for this body of research was to map and record the health and sustainability of the current Paa Harakeke on campus. This Paa is used by students for creative practice research and investigating tikanga in the modern world.

## 2. Methods

Visual Research was carried out through photographing and recording the various plants in order to develop a catalogue of the varying plant varieties. Plant pests and diseases were also recorded and analysed through this method.

Action research was also conducted through harvesting, preparing and weaving harakeke according to tikanga Māori while exploring the distinct properties of selected plants. In addition a self-reflective practice was maintained through journaling which recorded experiential learnings.

## 3. Results

The research produced a broad spectrum of results. The tangible include;

- A resource bank for student use that demonstrate the different properties of each puu harakeke in the paa. (Kono)
- A gathering of research to support students when engaging with the paa harakeke (readings, research, a map of the paa)
- Notes taken from conversations, experiences, research, etc...that detail tikanga surrounding harakeke which is essential in creative practice research.

Other observations include;

- The paa has remained un-used as a result of Covid. This has caused over-growth among the puu harakeke
- The paa is over-run by other native and non-native plants/trees that obstruct the puu harakeke from reaching their full growth potential.
- The paa is heavily affected by yellow-disease, natural pests, and brown spots, these are exacerbated by the lack of consistent irrigation to the site.



## 4. Conclusions

The paa harakeke is an invaluable resource belonging to the university, students and staff alike. In order to sustain this significant resource, all obstructing trees/plants amongst the harakeke need to be removed. All puu harakeke need consistent clearing out to allow for space, aeration and sun. Lastly, by implementing a hydration solution the paa will become consistently and adequately hydrated as harakeke flourishes in a damp environment. Thus, students will have access to quality resources enabling the continuation of creative practice research and investigation.

## Vocabulary

Harakeke - Phormium Tenax & Phormium Cookianum

Paa - Inhabitants of a place (harakeke)

Tikanga - Traditional Maaori Practices

Puu Harakeke - An individual harakeke plant

Kono - Traditional woven basket

## References:

Manaaki Whenua. (2021, January 19). *Insect Pests and Diseases of Harakeke*. <https://www.landcareresearch.co.nz/tools-and-resources/collections/new-zealand-flax-collections/insect-pests-and-diseases-of-harakeke/>

Orchiston, Rene. (n.d.) *Harakeke - The Rene Orchiston Collection*. [https://www.landcareresearch.co.nz/assets/Tools-And-Resources/collections/Harakeke-collection/Harakeke\\_3rdEd.pdf](https://www.landcareresearch.co.nz/assets/Tools-And-Resources/collections/Harakeke-collection/Harakeke_3rdEd.pdf)

Campbell, D. Simmonds, N. Pigs a, L. Waitoki, Waikaremoana, Raumati, Ng. Greensill, H. Manairangi, H. Philip-Barbara, G. Barbara, H. Beverland, M. Hond-Flavell, E. Tamati, A. Edwards, W. Hond, R. Treharne, G. Reremoana, T. Poulton, R. Ratima, M. Carlson, T. White, T. Tipene-Leach, D. Abel, S. King, P. Cormack, D. Kōpua, M. McLachlan, A. (2022). *Tiakiina te Paa Harakeke*.

Hetet, E. (2016). *Māori Weaving*.

Pendergast, M. (2008). *Fun with Flax*.



THE UNIVERSITY OF  
**WAIKATO**  
*Te Whare Wānanga o Waikato*

Research Intern - Maddisyn Hollis  
Project Supervisor - Donna Campbell  
Faculty of Māori & Indigenous Studies

Acknowledgments: To my whaanau Who continue to support me in my endeavours without expectation, Arohanui.

(Kylie Hollis, Elijah Nonoo, Julz Nonoo, Ronella Simon),



# DEVELOPING CULTURALLY RESPONSIVE PSYCHOLOGY CURRICULUM IN AOTEAROA NEW ZEALAND

## AUTHORS

Designed by Sophia Wairoa-Harrison  
Supervised by Kyle Tan & Waikaremoana Waitoki

## INTRODUCTION

Psychology training in Aotearoa New Zealand is dominated by Western viewpoints. WAI2725 outlines the Crown's failure to promote Māori-focused content in psychology and prepare a psychology workforce to meet the needs of Māori.

## OBJECTIVE

Track the progress of New Zealand universities in developing culturally responsive psychology curriculum. This analysis is in its third round, following Levy (2007) and Levy & Waitoki (2015) and is focusing on undergraduate papers.

## METHODOLOGY

A desktop analysis of psychology department undergraduate papers from:  
University of Auckland  
Massey University  
Auckland University of Technology  
University of Waikato  
Victoria University of Wellington  
University of Canterbury  
University of Otago

## ANALYSIS/KEY

- Specifically Māori focused:** A course led by a Māori academic and grounded in Kaupapa Māori philosophies and theories. The primary objective is imparting Mātauranga Māori (knowledge).
- Inclusion of Māori-focused content:** Discussion of Māori theories alongside other cultures or consideration of Māori psychologies within broader cultural perspectives.
- Inclusion of reference to culture:** Discussion of cultural perspective and differences without specific mentioning of Mātauranga Māori.
- No integration of Mātauranga:** Māori and diverse sources of cultural knowledge

Figure 1. Māori-Focused Undergraduate Psychology Course Content in 2022

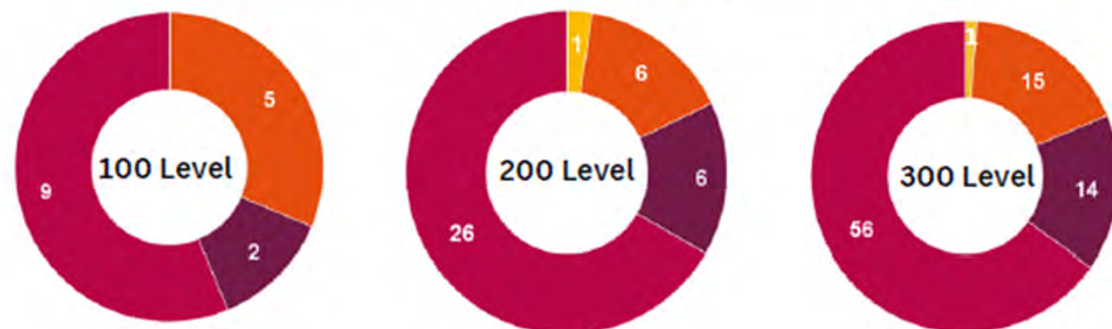


Figure 2. Number of Māori-Focused Courses across Three Timepoints



## RESULTS/FINDINGS

There were limited number of papers that fit the categories of 'specifically Māori-focused' (n = 2; 1.4%), 'inclusion of Māori-focused content' (n = 26; 18.4%), and 'inclusion of reference to culture' (n = 22; 15.6%). The breakdown of these findings according to level of studies are displayed in Figure 1 (100 Level), (200 Level) and (300 Level).

There was a significant increase in the numbers of papers reflecting 'specifically Māori-focused' and 'inclusion of Māori-focused content' categories from 2007 and 2015 (see Figure 2).

## CONCLUSION

There are some noteworthy wins in the development of a culturally competent undergraduate psychology curriculum in Aotearoa New Zealand. These include how Mātauranga Māori is incorporated into research methodology papers, neuroimaging papers, and degree offerings. However, the number of specifically Māori-focused papers has halved since 2007. Further research is needed to gauge students' experiences of the quality of cultural competency in these papers.

## BIBLIOGRAPHY

- Levy, M. (2007). *Indigenous psychology in Aotearoa: Realising Māori aspirations*. University of Waikato.
- Levy, M.P. & Waitoki, W. (2015). *Māori psychology workforce & Māori-focused course content review*. <https://researchcommons.waikato.ac.nz/handle/10289/9847>.
- Levy, M. (2018). WAI 2725 #1.11, *The psychology in Aotearoa claim: Statement of claim*. [https://forms.justice.govt.nz/search/Documents/WT/wt\\_DOC\\_137601318/Wai%202725%2C%201.101.pdf](https://forms.justice.govt.nz/search/Documents/WT/wt_DOC_137601318/Wai%202725%2C%201.101.pdf).



WORKING TO END RACIAL OPPRESSION



THE UNIVERSITY OF  
**WAIKATO**  
Te Whare Wānanga o Waikato



# Te Wānanga Pūtaiao – Division of Health, Engineering, Computing and Science



# uniting worlds

50th Anniversary Mural  
for School of Computing  
& Mathematical Sciences

Researchers: Filly Marin Arias and Jasmine Gorman

Supervised by Dr. Claire Timpany

Acknowledgements to Dr. Annika Hinze, Dr. Te Taka Keegan, all the staff members of CMS and the University of Waikato Summer Research Program



## Background

2023 is the 50 Year Anniversary of our acclaimed School of Computing and Mathematical Sciences.

## Problem

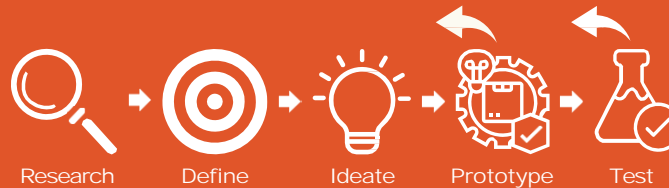
The Computing and Mathematical Sciences are seen as dull and isolated work fields. The stereotypes don't do justice to the vast and practical work these schools do together and their impact on the world around us.

## Aim

To design murals that celebrate all the exciting work done within SCMS, express the impact it has on our world, and bring a sense of unity to seemingly isolated fields.

## Method

Using the Design Method below, we performed this process multiple times to finalise our design, consulting with department staff along the way.



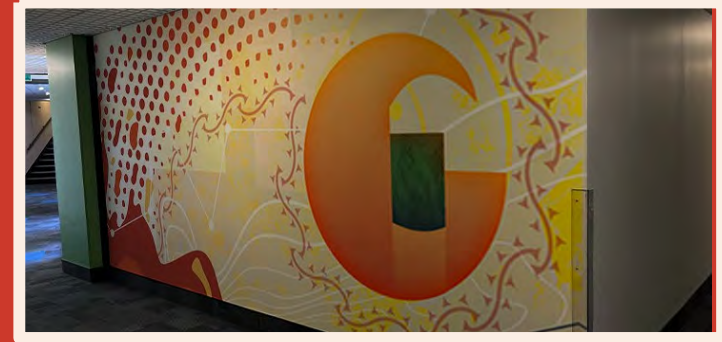
## Conclusion

These mock-ups show how our final mural design will look on the 3 floors of the FG Link building.

## Results

We have designed a mural representing the process and goals of Mathematics, Computer Science, Design and Software Engineering. The department's past, present and future work inspire the abstract imagery, plus the colours match those found throughout FG Block. Additionally, it was important for us to include visual ties to Waikato's Maori roots.

Floor 3



Floor 2



Floor 1



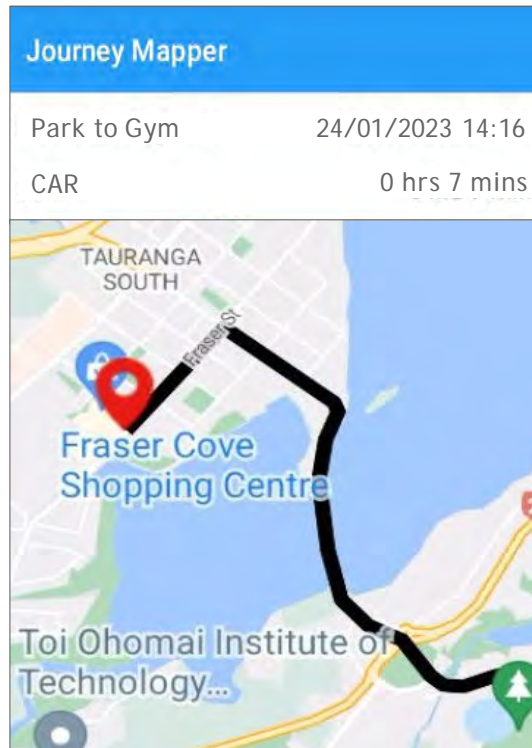


## INTRODUCTION

New Zealand has a sparsely located population. There are some urban cities but most of the country is made up of small rural communities which rely on the use of private vehicles for their transport. Existing research provides a bulk of understanding for urban city traffic movement trends and needs, but rural-based movement is less understood.

## PROJECT AIM

Use a small user study with rural-based participants to compare the accuracy between data gathered from a survey on commuting and real commuter data gathered using a mobile application.



Tracked commute using the smartphone application *JourneyMapper*

**Research by:** Zane Hamilton  
**Supervised by:** Dr. Jessica Turner  
Special thanks to the University of Waikato Summer Research Scholarship Programme for making this opportunity possible.

## METHODOLOGY

A comprehensive literature summary was completed first to review current data collection methods. A survey on commuting was created using the best method and distributed to participants, while also offering the opportunity to use the JourneyMapper application for a one week period. Analysis was then completed using the information gathered from both of the data collection methods.

## CONCLUSION

Both data collection methods provided effective insight for evaluating commuter behaviour in rural-based areas. Useful comparisons could be made between the accuracy of the survey information and real data.



## KEY QUESTION

Can we use a low discrepancy sequence within INLA to reduce the computational running time, without sacrificing accuracy?

### Bayesian Inference

Bayesian inference is a method of statistical inference that combines prior knowledge with data, to form an updated set of knowledge (known as the posterior distribution). This is done solely through the use of Bayes' Theorem, which states.

$$\text{Posterior} \propto \text{Prior} \times \text{Likelihood}$$

While Bayesian inference is easy in theory, it can be very computationally difficult in practice, especially for complex hierarchical models with more than a few hyperparameters.

### INLA

INLA is a fast approximate method of Bayesian inference for latent Gaussian models of the form:

$$\eta_i = \beta_0 + \sum_{l=1}^L \beta_l x_{i,l} + \sum_{m=1}^M f^{(m)}(u_{i,l}) + \varepsilon_i$$

INLA has many applications such as simple regression to complex hierarchical models, and is widely used in statistical modelling. However, it does suffer from the drawback of losing its computational efficiency when applied to models with many hyperparameters (generally, more than 5).

### Low Discrepancy Sequences

Low Discrepancy Sequences (LDS) are a type of deterministically generated point set. They are known to be more computationally efficient than random point sets and grids for numerical integration, both for accuracy and speed.

Figure 1 gives an example of a Halton sequence with 64 points in two dimensions (left), which has better space-filling, discrepancy, and projection properties than a random point set (middle) or a grid (right) with the same number of points.

### Method

Step 1: Identify three appropriate complex hierarchical model examples.

Step 2: Estimate model parameters using INLA with Grids. This will give the best but slowest approximations of the parameters.

Step 3: Generate Halton sequences, integrate this into the INLA code and estimate model parameters with the new sequences.

Step 4: Compare and contrast model summaries from INLA Grids and INLA LDS.

Example 1: Robust Regression (RReg) with Simulated Data

RR with 2HP	Points	Time (Secs)	HP Est	Intercept Est
INLA-Grid	67	0.582	0.249	1.138
Halton	32	0.525	0.25	1.142
Halton	16	0.523	0.25	1.124
Halton	8	0.505	0.25	1.119

$$\eta_i = \beta_0 + \beta_1 x_i + \varepsilon_i \quad \varepsilon_i \sim T_{d_j}$$

Robust Regression (RReg) is a simple linear model which assumes that errors follow a t-distribution with d-degrees of freedom, rather than a Normal Distribution. This model is mostly applied to data which tend to have a higher amount of variation in the errors.

The RReg example shown above has 2 hyperparameters. The INLA-Grid method uses 67 points and takes 0.582 seconds to run. Running a Halton sequence with 32 points takes less time (0.525 seconds) and gives comparable estimates with the INLA-Grid method. As we decrease the number of Halton points, the time continues to decrease, whilst still retaining good accuracy of the parameters. For the 8-point sequence, the hyperparameter estimates are equivalent to the INLA-Grid method while the Intercept estimate is not significantly different.

Example 2: Autoregressive model of Order 1 (AR1) with Simulated Data

AR1-3HP	Points	Time (Secs)	HP Est	Intercept Est
INLA-Grid	437	1.07	99.92	0.04
Halton	128	0.643	99.92	0.037
Halton	64	0.61	99.92	0.043
Halton	16	0.603	99.91	0.036

$$\eta_i = \beta_0 + f(\eta_{i-1}) + \varepsilon_i \quad \varepsilon_i \sim N(0, \sigma)$$

Autoregressive Model of order p (AR(p)) generally used for forecasting. the response variable is modelled so that it is dependent on what happened in the last p periods. This example illustrates an AR(1) model in which the current time depends on the previous time.

The AR1 model has 3 hyperparameters. The INLA-Grid method uses 437 points and takes 1.07 seconds to run. Running a Halton sequence with 128 points takes less time (0.643 seconds) and gives comparable estimates with the INLA-Grid method. As we decrease the number of Halton points, the time continues to decrease while still retaining good accuracy of the parameters. For the 16-point sequence, the hyperparameter estimate is the equivalent of the INLA-Grid method while the Intercept estimate is not significantly different.

Example 3: Zambia Malnutrition Model (ZMM) with Spatial Data

ZMM- 5 HP	Points	Time (Secs)	HP Est	Intercept Est
INLA-Grid	4118	200	1.26	0.103
Halton	512	39.2	1.26	0.110
Halton	256	22.2	1.26	0.109
Halton	64	12.4	1.26	0.108

$$\eta_i = \beta_0 + \beta_1 rcw_i + \beta_2 edu_i + \beta_3 sex_i + \beta_4 tpr_i + f_1(bmi_i) + f_2(agg) + f_3(x_i) + f_4(x_i) + \varepsilon_i$$

Zambia Malnutrition Model (ZMM) was first introduced in 2001 by the official statistics department in Zambia. It models various spatial factors to determine the rate of malnourished children in an area. It is a complex hierarchical spatial model with five hyperparameters.

Running ZMM using an INLA-Grid method uses 4137 points and takes 200 seconds to run. and gives us the hyperparameter of 1.26 and the Intercept estimate of 0.103. Running the Halton sequence with 64 points takes less time (12.4 seconds) and provides us with comparable estimates with the INLA-Grid method. As we further decrease the number of Halton points, the time continues to decrease while still maintaining the accuracy of the parameters. For the 64-point Halton Sequence, the hyperparameter estimate is not significantly different.

### References

- Bolstad, W. (2010): *Introduction to Bayesian Inference, 2nd Edition*. Wiley, New Jersey.
- Wang, X., Yue, Y., Faraway, J.J. (2019): *Bayesian Regression Modelling with INLA*. CRC, Boca Raton.
- R-INLA Project. (n.d.). <https://www.r-inla.org/>

### Acknowledgements

I would like to thank Dr Paul Brown for all the guidance and support he provided in this project and the University of Waikato for providing these opportunities to students through the Summer Research Scholarships.

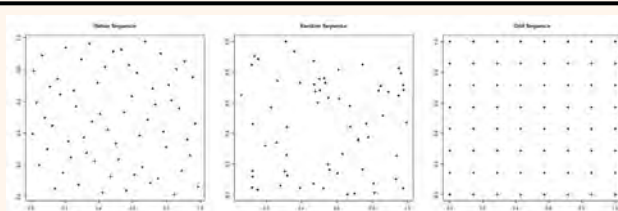


Figure 1: Halton Sequence with 64 points (Left), A random point set with 64 points (middle), a Grid with 64 points (Right)

## KEY OUTCOME

Using a low discrepancy sequence within INLA reduces computational running time whilst providing accurate parameter estimates of a model.

## BACKGROUND

Ahau aims to protect and preserve knowledge through the digitisation and encryption of data. Ahau creates and distributes open-source software that enables whanau-based communities to store and share important information such as whakapapa records and cultural narratives

## PROBLEM

Whakapapa's need the ability to create a submit-only whakapapa where members require approval from a moderator (kaitiaki) for any changes made to the whakapapa. Approval can be requested, then approved or rejected through a notification system.

## SOLUTION

The solution uses GraphQL, Vue and Secure-Scuttlebutt (ssb). Vue provides a front-end framework to display submission requests and approvals. GraphQL is a data query language to allow communication with the server. Ssb is a peer-to-peer network protocol that allows data to be transferred and stored between computers.





# DEVELOPING MOBILE GAMES FOR EMBEDDING COMPUTATIONAL THINKING INTO TECHNOLOGY PRACTICE

## INTRODUCTION

The recently introduced New Zealand digital technology curriculum requires all students to be taught computational thinking skills. This is to prepare students for a world in which digital competency is more valuable than ever.

## OBJECTIVE

This tasks for this project were to: (a) conduct a literature review in relation to computational thinking in education and (b) refine the previously-developed mobile application, Kite, which is designed to assist in the development of such skills.

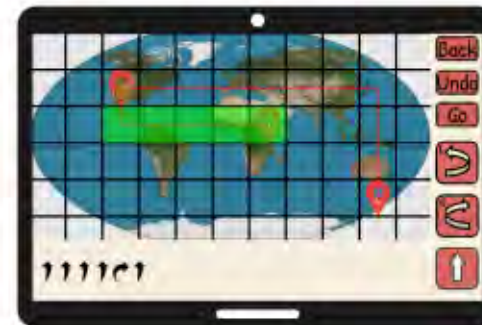
## METHODOLOGY

The literature review was conducted primarily using previously compiled academic research. The app was refined using the open-source software development kit Solar2D. It was designed for usability and to incorporate new functions.

## LITERATURE KEY FINDINGS

- Computational thinking is not just programming, but a set of 'mental tools' that can be used to solve complex problems and design systems.
- Teacher understandings of computational thinking varied. A common misconception was that it had to be taught using computerised tasks.
- Different tools were used to teach computational thinking, including Bee-Bots or iPad apps. The use of these tools improved teamwork, communication, and the confidence of both teachers and students.
- Cross-curricular learning could be achieved in areas such as maths, physical education, literacy and art.

## APPLICATION DESIGN



This application was designed to allow users to design their own 'tour' using a map. A new sequence mode was added which allows a sequence of directions to be inputted before they are executed all at once.

The shortest path between the different points on the map can also be revealed (as shown in red on the left).

## CONCLUSION

Most academic studies involving computational thinking in education focused on whether outcomes could be achieved rather than on the specifics of the learning program. In particular, there was a lack of research on the use of authentic learning contexts to teach computational thinking, despite this being a requirement of the New Zealand Curriculum. As such, the app was designed to be able to create a 'tour' which would serve as the authentic learning context for students. It is intended that this would be used in a future study to determine the effect of such a context on learning outcomes.

### References:

- [1] Wing, J. M. (2006). Computational thinking. *Communications of the ACM*, 49(3), 33-35.
- [2] Irons, J. & Hammett, M. (2020). Computational thinking in junior classrooms in New Zealand. *Journal of Open, Flexible and Distance Learning*, 24(2), 28-42.
- [3] Duncan, C., Bell, T., & Atlas, J. (2017). What do the Teachers Think? *Proceedings of the Nineteenth Australasian Computing Education Conference On - ACE '17*



By Tiana Mayo  
Supervised by Shaoqun Wu & Wendy  
Fox-Turnbull



## Introduction

ReadingPeople is a Summer Research Scholarship centered on developing an Android application with the Tini o te Hakituri project. It collects physiological data from the Mindfield eSense Galvanic Skin Response sensor and Polar H10 Heart Rate sensor so that it can be processed to reveal useful fatigue information. Tini o te Hakituri investigates innovative, ethical, and evidence-based technology uses in hazardous work environments, including physiological data, to identify fatigue and workload in the NZ Forestry Industry and, more recently, the Kiwi Fruit industry.

## Acknowledgements

The University of Waikato  
Summer Research  
Scholarship  
Tini o te Hakituri Project

## Conclusion

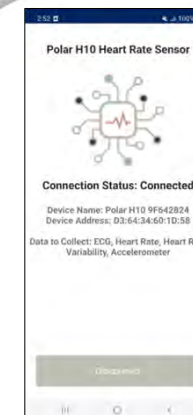
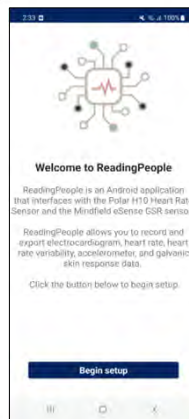
Through a combination of Java libraries and the Polar and Mindfield SDKs, we were able to connect to and gather a range of valuable physiological data from each of the sensors that can be used for further analysis of fatigue information. The app was designed with a high focus on code reuse, easily updatable code, and making as much use as possible of the SDKs rather than writing our implementation, e.g., scanning for available Polar sensors.

# ReadingPeople: An Android Application for Physiological Measurement



## Methods

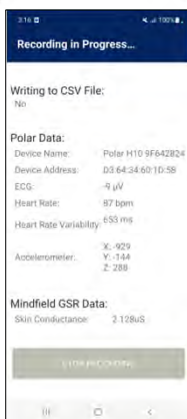
The Mindfield eSense Galvanic Skin Response sensor transfers data via a headphone jack, and the Polar H10 Heart Rate sensor transmits data via Bluetooth. Polar and Mindfield have software development kits (SDKs) that give developers code to connect and extract sensor data. The Polar SDK collects ECG, heart rate, heart rate variability, and accelerometer data. The Mindfield SDK enables skin conductance data to be collected.



## Results

Once the app is installed

1. Select the sensor/s to connect to
2. Accept the permissions for the chosen sensor/s
3. Connect to the sensor/s
4. Select how you would like to view the data (write to file or/and display on screen)
5. Begin recording
6. App begins collecting the selected data
7. Finish the recording







## What is Ahau?

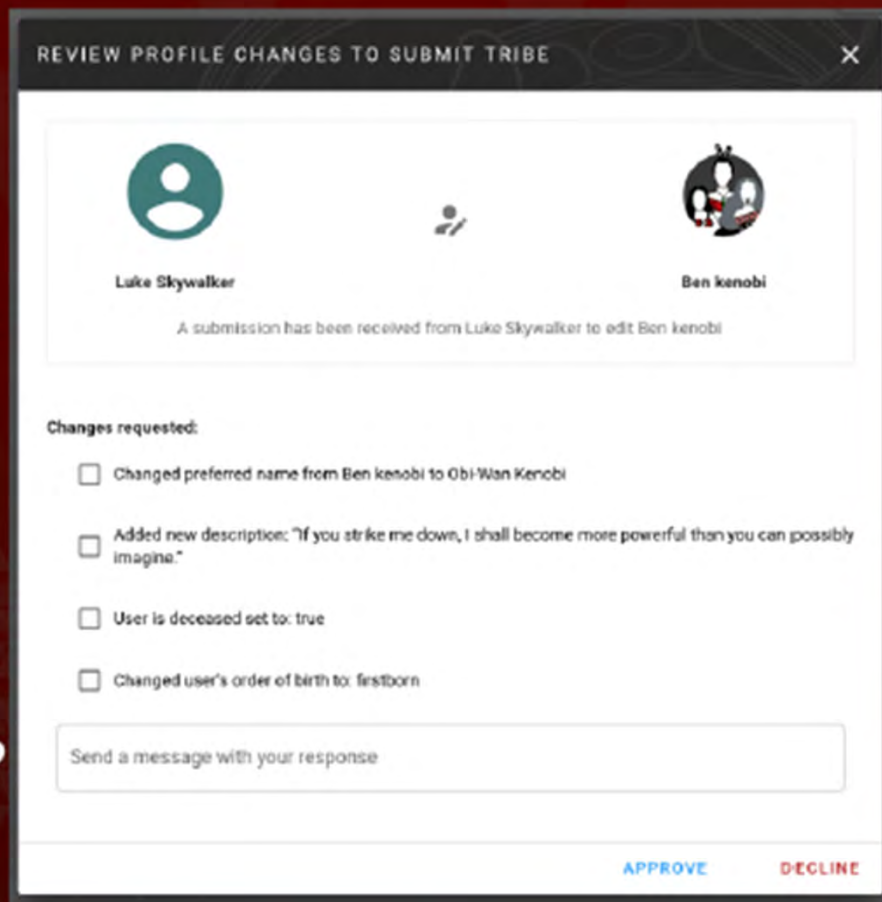
Ahau is an app that enables iwi to share cultural histories, create tribal registries, and network with whanau. But the killer feature is the focus on data sovereignty: data is owned and controlled by the communities that use the app rather than a company!

## How does it work?

Ahau allows iwi to create a whakapapa: a group that contains a family tree and allow a tribe to share information. Users known as Kaitiaki act as admins of a whakapapa and can add to the tree, edit and delete profiles, maintain cultural records and more.

## How can it improve?

Putting all the control in the hands of the Kaitiaki greatly hinders community engagement, so the app needed a new feature: the ability for users to request changes to the whakapapa, which the Kaitiaki can then approve or decline.



## Sounds simple right?

Usually this wouldn't be a tough feature to implement, but to put control of data in the users hands Ahau needed a fairly unusual method of data storage: a distributed database. This added unique and challenging design considerations when trying to add the feature, on top of UI design and usability.

## How did it go?

You can see the result on the left! Working together with a fellow Waikato University student, we created a database to store info related to the request, wrote methods to set and retrieve that data, and finally designed and implemented a user friendly UI that allows users to request edits to profiles and Kaitiaki to approve or decline those requests.

# Māori and Pacific student success in STEM fields: exploring ten years of data

## BACKGROUND

Māori and Pacific students face gaps in tertiary retention and achievement, particularly in the areas of science, technology, engineering, and mathematics (STEM). A number of initiatives at University of Waikato aim to address these gaps, all rely on high-quality data about student experience.

## AIM

1. To research contributors and challenges to the success of Māori and Pacific students.
2. Aims to understand the contributors for student success and barriers to success, to inform student support and staff professional development at the University of Waikato and beyond.

## METHOD

We worked extensively on students' data specifically analysing the year 2020 when covid-19 began to impact New Zealand and the rest of the world.

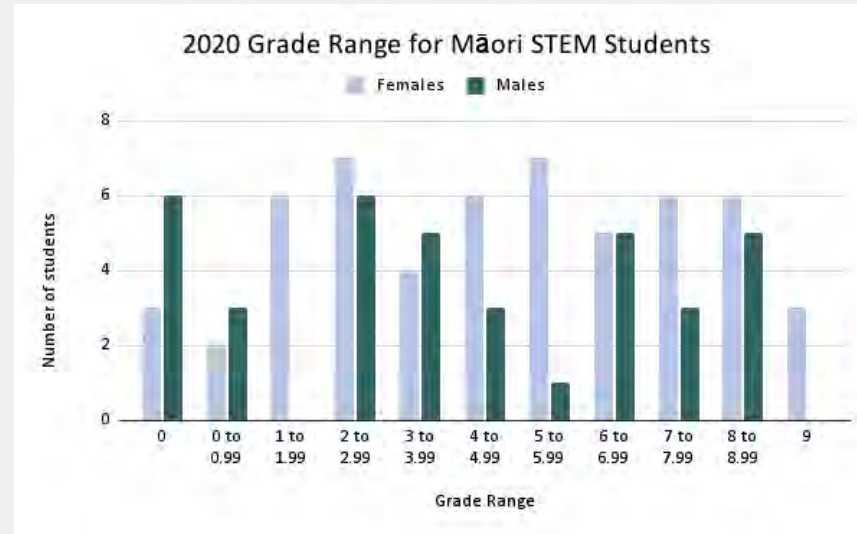


Figure 1

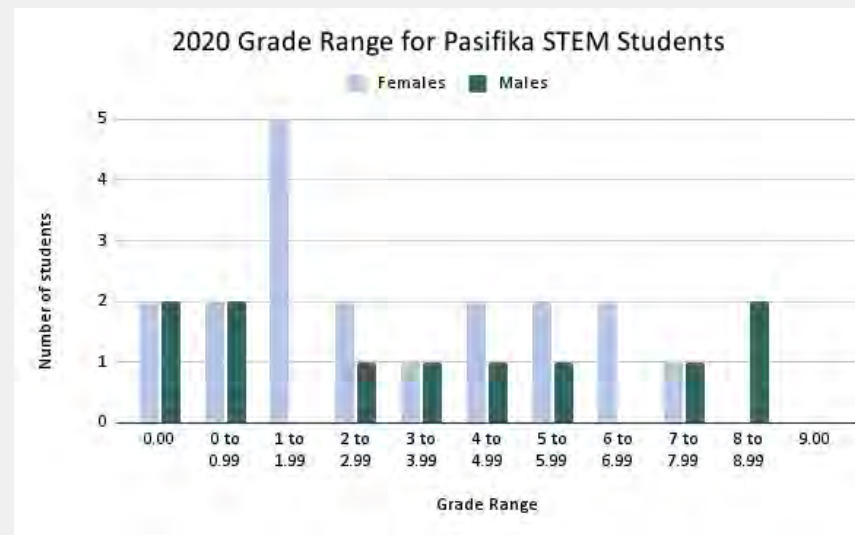


Figure 2

## RESULT

In 2020:

1. According to the data, the dominating gender for the new incoming students at the University of Waikato was females.
2. Figure 1 and 2 show that grade ranges and memory retention are areas which require special focus and improvement

## CONCLUSION

More effort is required towards educating and empowering Māori and Pasifika students providing them with knowledge and tools which they need to achieve higher results. There is still ongoing research surrounding the previous years of data which can shed more light into how we can support Māori and Pasifika students to become higher achievers





# An Android Application for Workload Prediction

by Jascha Penaredondo, supervised by Jemma König and Annika Hinze

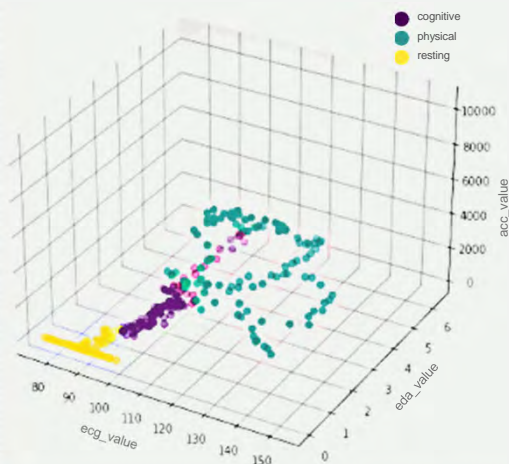
## BACKGROUND

As of 2021, the Agriculture, Forestry and Fishing industry still has the highest accident rate amongst all other industries. [1] One of the leading cause identified for this rate is worker fatigue since it is both a physically and mentally-demanding job.

## PROBLEM

Being able to identify the current workload (i.e. resting, physical or cognitive fatigue) of the worker would be beneficial to better handle hazardous situations. The Hakituri Project has an existing dataset of sensor readings from a simulated study of forestry work. However, the readings can vary from person to person which can lead to unreliable and inaccurate workload prediction.

## The Clusters of the Classes



## OBJECTIVE

Develop an application that uses machine learning to ultimately predict workload based on individual sensor readings. This will have an automated component which reads and aggregates data from the sensors to be processed.

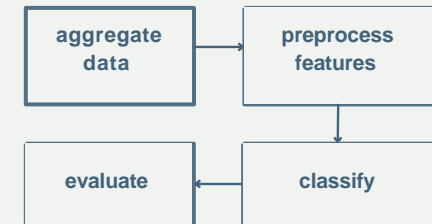


## METHOD

The creation of the application can be split into two parts - android studio and machine learning.

The Android Studio component will provide the functionality and aesthetic of the application which will follow two key ideas: user-friendly interface design and modular programming.

The machine learning component of the application will train and model the data to be used within Android Studio, using the following steps:



## RESULTS

The graph shows a clear separation between the different classes (i.e. cognitive, physical, resting) with a few overlaps. The machine learning model of the application uses the KNeighbours Classifier, and splits the data into a training and test set of 80% and 20% respectively. The accuracy of the model is evaluated on one participant's data at a time.



Scan the QR code to view the app!

## CONCLUSION

The use of machine learning provides an algorithm that can independently adapt as the model is exposed to more data, making the application more robust and reliable. The app will be especially useful in identifying patterns of worker fatigue, and ultimately decrease the accident rate within hazardous industries like Forestry. With its simplistic and modular design, the app can potentially be interfaced with other applications for further studies.

## ACKNOWLEDGEMENTS

The Tini o te hakituri Project: Judy Bowen, Annika Hinze, and Jemma König  
University of Waikato Summer Research Scholarship

## REFERENCES

[1] <https://www.stats.govt.nz/information-releases/injury-statistics-work-related-claims-2021>

# Monitoring the Health of Urban Trees



## Artificial Intelligence Based Tree Registry System with YOLOv5 and GPS Location Mapping

## INTRODUCTION

### BACKGROUND

Trees in urban landscapes provide a range of economic, social, and environmental benefits (ecosystem services), and cities and municipalities worldwide[1]. Trees help mitigate climate change [2], reduce noise, and soil erosion, clean air pollution, act as natural stress relievers and contribute to higher property prices. Our research team use moving vehicle with a camera to monitor the health of our urban rākau (trees).

### PROBLEM

Manual detection of urban tree is costly. Currently, there are no appropriate technological tools to provide analytics of sick trees in the urban area.

## RESEARCH

### AIM

To develop a system that will

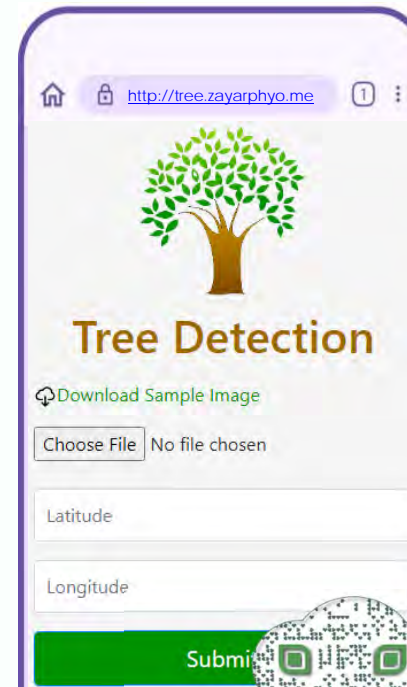
- Automatically recognize the given input image with annotated result as output
- Artificial Intelligence based solution to detect correctly
- Automatic tree registry with unique tree identification number and GPS location

### METHODOLOGY

- Create datasets with tree names are annotated with bounding boxes in Roboflow
- Split dataset into 60% for training, 20% for validation, and 20% for the testing set
- Train dataset with YOLO as the Deep learning based object detection algorithm

- Export the best training model into python-based web application

### RESULTS



## CONCLUSION

### CONCLUSION

User-friendly system with automatic creation of trees registry for a given driving route.

Facilitates regular monitoring of urban trees to identify what kind of trees each street has and whether they look damaged by pests or disease.

This application is part of a tool created for the NZ biological heritage national science challenge.

### REFERENCES

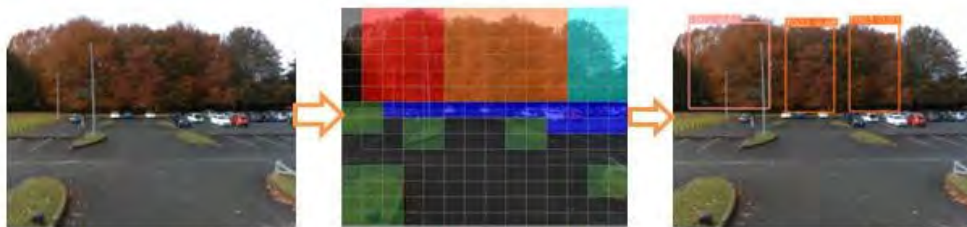
- 1 Te Uru Rākau, Importance of New Zealand forests
- 2 Meurisse and Bulman, Farm Forestry New Zealand
- 3 National Science Challenges Goal, State-of the-art-surveillance, Spectral imaging for urban tree health

### ACKNOWLEDGEMENTS

- Supervised By  
Dr. Michel Mayo and Dr. Melanie Ooi
- Special Thanks to  
Ye Chow Kuang and Clint Dilks
- Acknowledgements to University of Waikato Research Program

### CONTACT INFO

- [ygnzayarphyo@outlook.com](mailto:ygnzayarphyo@outlook.com)
- +64 022 1300 982
- <http://zayarphyo.me>



Input Image

Bounding Boxes at Trees

Annotated Trees



# Thesis Typography: Te Reo meets English

Miriama Royal Supervisor: Dr. Claire Timpany

## Aria / Abstract

### Te Kōpura

Until the European settlers came to Aotearoa, Te Reo Māori was an oral language. The visual presentation of Te Reo as a written language is based on westernised document design convention and thought processes. This research is to find the difference in structure and style within theses written in partial and full Te Reo compared to English theses.

## Tīmatatanga / Introductions:

### Whakamārama, Wehewehengā, Te Tātarima...+

Exploring the examples of theses from the Waikato University database and other tertiary schools databases, I am comparing the visual presentation and structuring differences for theses published in Te Reo. This includes comparing the typefaces, point sizes and layout, across different sections of the thesis. It is important to see the development over the years to see if there is a change in how theses in Te Reo are displayed and understand if they have their own style rather than the westernised expectations.

## Acknowledgements:

### Whakanui, Ngā Mihi, Tuku mihi, He Mihi aroha...+

I would like to extend my appreciation to Dr. Claire Timpany for her guidance and for giving me the chance to be a part of this research. Additionally, I am grateful to Niki Kennedy, Te Taka Keegan, Alistair Lamb for their support and mentorship throughout my research, and to the Summer Research Scholarship for providing opportunities to many students during the summer.

A timeline charting the evolution of font usage in theses over the years, highlighting the most popular choices and how they have changed over time.

1980s Times New Roman

1990s Times New Roman Arial Helvetica

2000s Times New Roman Minion Pro Arial Helvetica

2010s Times New Roman Arial Helvetica Garamond

2020s Times New Roman Garamond Georgia Calibri Helvetica



With the use of a word cloud I have chosen to show other titles and sections that have been used in different Te Reo theses over the years

## Whakatau / Conclusion:

### Kōrero Whakakapi, Āpiti hanga Tuwaru...+

Through the analysis of theses submitted in Te Reo across tertiary institutions in Aotearoa, I have found that the most common typefaces used have evolved. The increased availability of fonts has allowed for greater expression of identity in the visual presentation of these documents. Despite limitations in the availability of fonts specifically for Te Reo, individuals are pushing beyond traditional font choices to further express themselves. I have learned that the style for Te Reo theses is seen more in the format than the visual aspects. I am hoping as I continue my research to find other fonts that would identify better with the language. Although Te Reo as the written word is influenced heavily by European ideals, the unique style of Maori storytelling still comes through. In the westernised structure of storytelling, there is a start, a middle, and an end. It seems that the typical structure of a thesis is not always as closely followed in a thesis published in Te Reo.

## Ngā Upoko / Chapters:

### Te Wāhanga, Tipuranga, Te Wai Whakaihō

Tasks I have undertaken in the process of conducting this research:

Finding examples of theses written in partial and full Te Reo from around Aotearoa

-Documenting for each tertiary institution and the theses published in Te Reo ordered chronologically

-Recording the fonts, point size and font style for the Headings, Sub Headings, Body text, footnotes and descriptions.

-Recording how the theses are formatted and structured including the different title or sections names used, and sections that differ between languages such as adding a Karakia, pepeha etc.

-Eventually going on to look at the imagery used. Does it have a border using Kōwhaiwhai patterns or traditional imagery to support the thesis or to represent their heritage?

Future steps will be to interview the authors to see why they used the styles they did, if they would do anything differently if they had the technology available now, and understand the thinking by the authors of theses that have used a more alternative route.

Although Te Reo as the written word is influenced heavily by European ideals, the style of storytelling still comes through. In the westernised structure of storytelling and in this research's case there is a start, a middle and an end. I have tried to narrow down some of the many headings that correspond to the standard European headings.



THE UNIVERSITY OF  
**WAIKATO**  
Te Whare Wānanga o Waikato





## Background

Extended Reality (XR) encompasses all 3D immersion of the virtual environment, such as Virtual Reality (VR) and Augmented Reality (AR). XR development has increased significantly since 2010<sup>1</sup> due to the advancement of headset and computer hardware. Notably, there has been more interest in the education sector regarding XR development.

## Problem

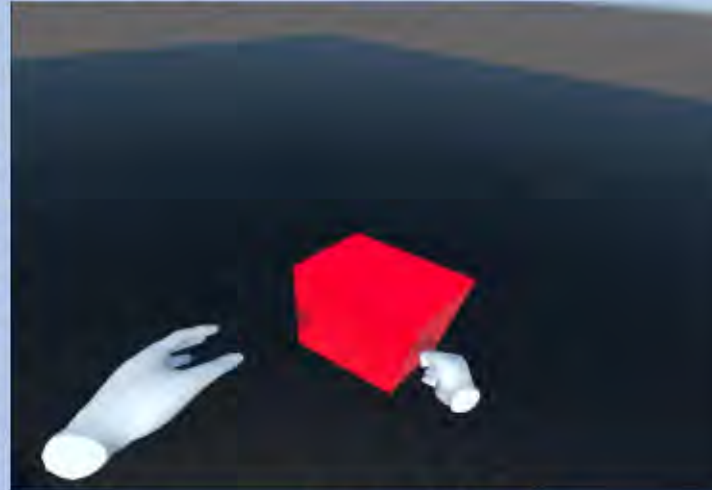
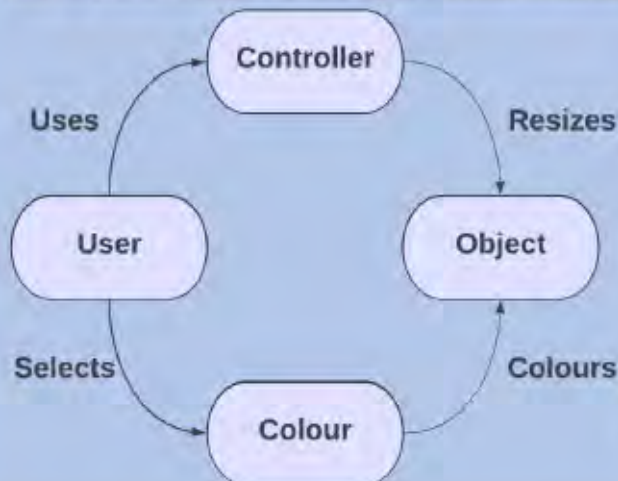
We need to explore XR technologies implemented in universities.

## Aim

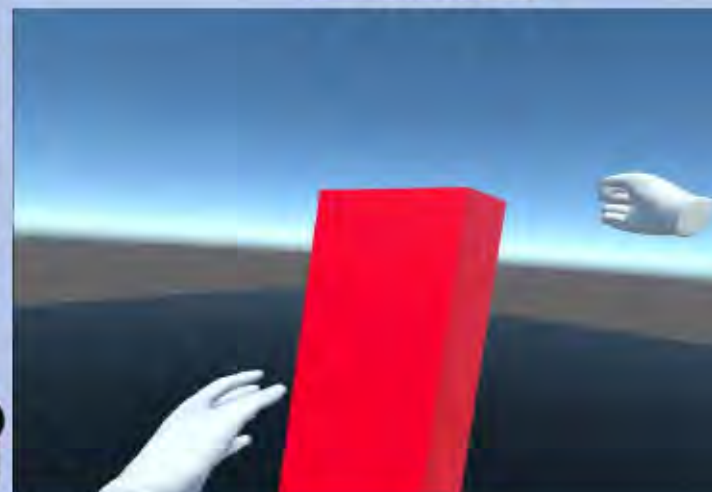
Find XR technologies in universities and create an application to effectively help students to learn using 3D immersion.

## Method

A systematic literature review was conducted to find existing XR technologies. As a result of this study, a VR app was created to teach geometry to students by helping them visualize shapes using an oculus headset.



View  
App



## Results

The app allows the user to select shapes to manipulate from a selection panel. The dimensions of the shape is displayed and can change in real time as the user interacts with the shape. The colour of the shape can also be changed by the user for ease of visualization.

## Conclusion

This app helps individuals to visualize the dimensions of 3D shapes and can be used to learn the properties of shapes dynamically through live interaction with the shapes. Immersive 3D research and development is accelerating at a remarkable rate<sup>2</sup> and utilizing its potential in education can lead to increased student motivation<sup>3</sup> due to the interactive experience.

## Acknowledgements

I would like to thank my supervisor Jessica Turner for giving me this opportunity and for the consistent support I've had throughout the project. I would also like to thank the University of Waikato for making this project possible.

## References

- [1] Venkatesan, M., Mohan, H., Ryan, J. R., Schurch, C. M., Nolan, G. P., Frakes, D. H., & Coskun, A. F. (2021). Virtual and augmented reality for biomedical applications. *Cell Rep Med*, 2(7), 100348. <https://doi.org/10.1016/j.xcrm.2021.100348>
- [2] Bacca-Acosta, J., Avila-Garzon, C., Kinshuk, Duarte, J., & Betancourt, J. (2021). Augmented Reality in Education: An Overview of Twenty-Five Years of Research. *Contemporary Educational Technology*, 13(3). <https://doi.org/10.30935/cedtech/10865>
- [3] Kluge, M. G., Maltby, S., Keynes, A., Nalivaiko, E., Evans, D. J. R., & Walker, F. R. (2022). Current State and General Perceptions of the Use of Extended Reality (XR) Technology at the University of Newcastle: Interviews and Surveys From Staff and Students. *SAGE Open*, 12(2). <https://doi.org/10.1177/21582440221093348>



# DOES INCLUDING MĀORI LOANWORDS IN ADS CHANGE HOW THEY ARE PERCEIVED?

By Mitchell Williams, supervised by Nicholas Vanderschantz and Andreea Calude

Investigating how the language we use in health advertising changes perceptions of cultural appropriateness.

## 4. DISCUSSION

- Our study is the first of its kind to investigate people's explicit attitudes towards the use of Māori loanwords in New Zealand health advertising.
- Preliminary results suggest that ads that include Māori loanwords are perceived as more culturally appropriate for Māori audiences than fully English ads.
- However, the Māori "loanword" used in the pseudoword ad did not have any real meaning. Therefore, the fact that participants found this ad to be more culturally appropriate than the fully English ad for Māori is worrying.
- Further research should investigate the possible correlations between an individual's level of Māori orientation with their attitudes towards ads with real and fake Māori loanwords.



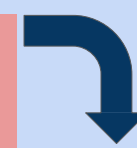
**Acknowledgements** to the University of Waikato Summer Research Program. **Special thanks** to Maryanne Garry for their insight on good experimental design.

## REFERENCES

- 1 Hornikx, J., & van Meurs, F. (2020). *Foreign Languages in Advertising Linguistic and Marketing Perspectives* (1st ed. 2020). Springer International Publishing. <https://doi.org/10.1007/978-3-030-31691-4>
- 2 Kubat, U., & Swaminathan, V. (2015). Crossing the cultural divide through bilingual advertising: The moderating role of brand cultural symbolism. *International Journal of Research in Marketing*, 32(4), 354–362. <https://doi.org/10.1016/j.ijresmar.2015.04.003>
- 3 van Hooff, A., van Meurs, F., & van Mierlo, I. (2019). Bilingual Consumers' Response to the Use of Catalan and Spanish in Advertising in Catalonia. In *Advances in Advertising Research X* (pp. 177–189). Springer Fachmedien Wiesbaden. [https://doi.org/10.1007/978-3-658-24878-9\\_14](https://doi.org/10.1007/978-3-658-24878-9_14)

## 1. BACKGROUND

- Loanwords are words from one language that are used in another. For example, "kia ora" are Māori loanwords used in New Zealand English.
- Research has shown that using loanwords in advertising can improve the effectiveness of an ad [1].
- However, mixed-language advertising is more appropriate for some products than others [2], and bilingual consumers tend to find ads in mixed languages to be less culturally appropriate than ads in one language [3].
- Therefore, it is important to understand whether using Māori loanwords in New Zealand health advertising is a culturally appropriate and beneficial practice.



## 2. AIMS

**Research Question:** To what extent does including loanwords in health advertising affect consumer attitudes towards the ads?

**We want to know:**

1. Whether attitudes towards ads with mixed language (Māori loanwords) are significantly different from ads in one language (English).
2. Whether how commonly used a loanword is moderates consumer perceptions.



## 3. METHOD AND RESULTS

To answer our RQ, we presented participants with 1 of 3 near-identical NZ health ads: Monolingual (**English word** = "family"), Mixed language (**Real Māori loanword** = "whānau"), or Mixed language (**Fake Māori pseudoword** = "kūoka").



VS

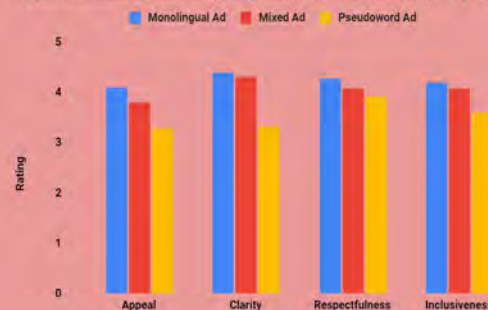


VS

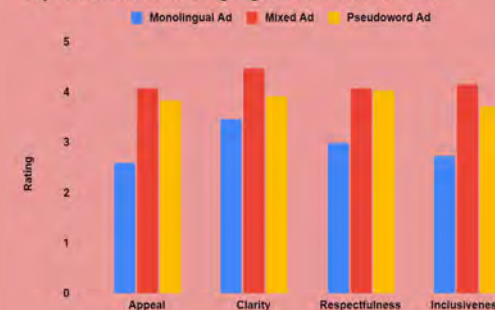


Participants then rated how **appealing, clear, respectful,** and **inclusive** they found the ad to be for **NZ European** and **Māori audiences**. These measures were chosen to provide a holistic understanding of **cultural appropriateness**.

Explicit Attitudes to Language used in Ads for NZ Europeans



Explicit Attitudes to Language used in Ads for Māori



- The Monolingual ad ("family") was rated as the most appealing, clear, respectful, and inclusive ad for NZ European audiences.
- The Mixed language ad ("whānau") was rated as the most appealing, clear, respectful, and inclusive ad for Māori audiences.

# Development of surrogate heat exchanger models for vapour compression cycles



THE UNIVERSITY OF  
**WAIKATO**  
*Te Whare Wānanga o Waikato*

## AUTHORS

Supervisor(s):  
Associate Prof. James Carson  
Dr. Duy Hoang  
Researcher:  
Abdulrahman Al Yahmudi  
(ID: 3354274)

## AFFILIATION

HECS - School of Engineering  
Field - Energy Engineering  
University of Waikato  
Ahouora project (Centre for smart energy systems)

## 1. INTRODUCTION

The project belongs to Ahoura's heat decarbonisation aim (2) which states to model process heat and energy utility systems. A research of development surrogate models of heat exchangers with different heat phase change (single phase or two phase) that occurs in different type of heat exchangers (Plate, shell and tube, fin tube, double pipe, etc.) for vapour compression system. The models provide several developed correlations of heat transfer coefficients and pressure drop based on experimental operation conditions to make them easier to incorporate into digital twins.

## 2. CLASSIFICATION OF HEAT EXCHANGERS BASED ON DESIGN PROJECT DIAMGRAM



## 3. RESERCH CONTRIBUTION

More GreenA in government for achieving net



carbonisation in 2050

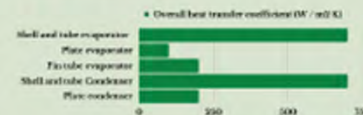
## 4. OBJECTIVE

- Analyzing the Mitsubishi Q-ton CO<sub>2</sub> transcritical heat pump
- Modelling different types of heat exchangers for both gas cooler/condenser and evaporator with different heat transfer mechanism
- Development for the overall heat transfer coefficient and pressure drop correlations.

## 5. METHODOLOGY

- Literature review from relevant topics
- Design models for different heat exchangers using Excel approach based on Q-ton heat pump operation conditions
- Polynomial equations for developed heat transfer coefficients and pressure drops

## 6. ANALYSIS



## 7. RESULTS

1  $1/U = [-0.0009 (T_{diff})^2 + 0.1607 (T_{diff}) + 6.8021] \cdot R$

This equation only valid for Q-ton heat pump plate heat exchanger condenser operation conditions.   
★★★★★ (Polynomial equation with R-2 = 0.9969)

2  $1/U = [1 \times 10^{-4} (T_{diff})^5 - 3 \times 10^{-6} (T_{diff})^4 + 0.0002 (T_{diff})^3 - 0.0102 (T_{diff})^2 - 0.296 (T_{diff}) - 0.1796] \cdot R$

This developed correlation is valid for plate heat exchanger single phase with constrains:   
★★★★★ (Polynomial equation with R-2 = 1)

Hot fluid:  
Reynolds number 219-Re<758  
Prandtl number 1.2-Pr<2.9  
Cold fluid:  
Reynolds number 44.6-Re<492  
Prandtl number 2.1-Pr<4.4

• Where  
T<sub>diff</sub> is the inlet temperature difference of two fluids (°C)  
R is the conduction heat transfer (W / m<sup>2</sup> °C)

## 8. FUTURE WORK

- Implementation of more design models of heat exchangers
- Development of more accurate simple correlations for heat transfer coefficients
- Development of correlations for total fluid pressure drops
- Evaluation for the driving force influence on the heat transfer

## 9. REFERENCES

- Smith, R. In d.1. Heat exchanger. In R. Smith. Chemical process design and integration, Chapter 12 (225-348).  
Kuznetsov, V. V. (27 June 2016). TWO-PHASE HEAT EXCHANGERS. In Handbook of thermal Science and Engineering (pp. 1473-1500). SpringerLink.

## 10. ACKNOWLEDGEMENTS



Project Ahoura (Centre for smart energy systems)  
This project aims to develop a novel energy-technology platform based on adaptive digital twin technology and underpinned by the next-generation of energy systems science. The team focuses on developing effective solutions through the smart integration of physical and digital energy technologies in the most synergistic way.  
Aim (2)  
To achieve zero net emissions in 2050, Aim 2 of Ahoura's project heat decarbonisation is concerned with modelling process heat and energy utility systems.  
Aim's leader: Associate Prof. James Carson.

Wants to read more





# Wind-uplift capacity of aluminum super seam and interlocking cladding-numerical investigation



Yaqoob Al-Fazari  
Supervisor: Dr. Krishanu Roy - Zhiyuan Fang

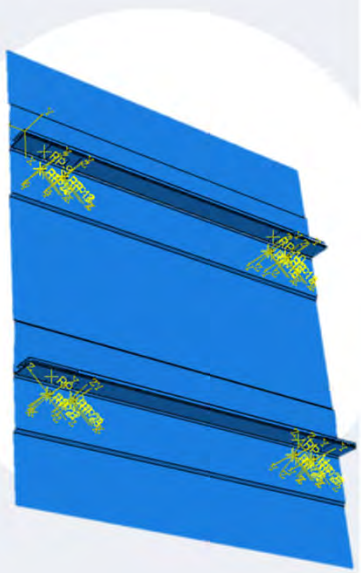


## Introduction

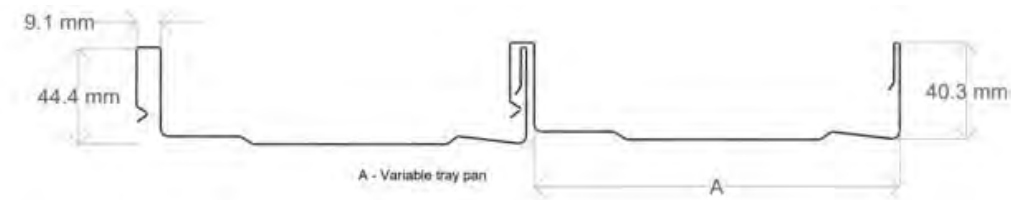
Roofs are crucial to every building. It shields the building from wind and weather. It also insulates and enhances the overall look of the structure. There are three main materials used for cladding in New Zealand and they are steel, copper, and aluminum. New Zealand has about 15,000 km of coastlines which makes steel unwanted due to its vulnerability against corrosion, and copper is expensive which makes aluminum the best option. Some of the advantages of aluminum are:

- Corrosion resistance
- High strength-to-weight ratio
- Easy fabrication
- Sustainable, and lightweight

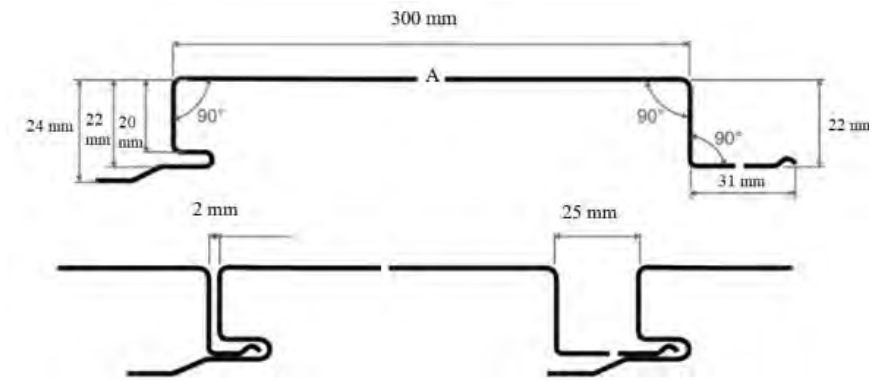
However, there are no appropriate design standards for two of the most used cladding profiles in aluminum which are the TRS super seam cladding and the TRS interlocking cladding.



## Designs



Cross section of the super seam cladding

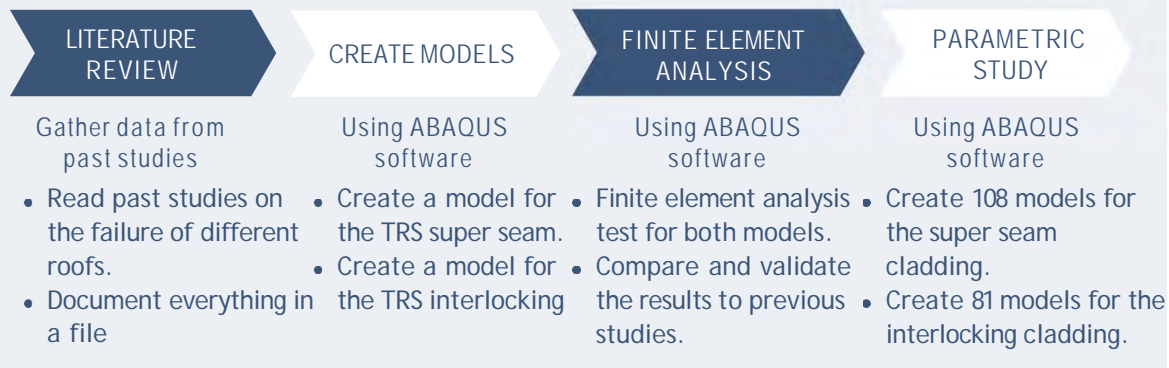


Cross section of the interlocking cladding

## Project Objectives

- 1 Conduct a literature review on aluminum roof cladding
- 2 Design models using ABAQUS and validate them using exciting studies
- 3 Do a parametric study for the super seam using 108 models
- 4 Do a parametric study for the interlocking cladding using 81 models
- 5 Investigate the effect of three main parameters on the two cladding profiles

## Methodology



## Results and outcome of the reserach

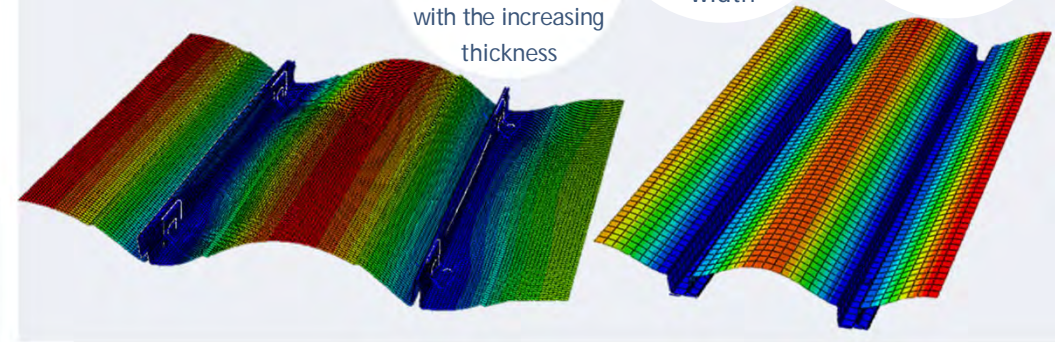
The parameters investigated

- Yield strength
- Span of cladding
- Thickness of cladding

It was found that the failure loads for the cladding increased linearly with the increasing thickness

The failure loads significantly increased with decreasing span width

Higher yield strength led to higher failure loads for all claddings



## Acknowledgments

I would like to thank Dr. Kris Roy for giving me this opportunity tom work on this project and for believing in me. His trust, help, and guiding are the key components for the success of this project. I would also like to thank my second supervisor Arthur (Zhiyuan Fang) for his continues support and help for the duration of the project. Without him, It would be impossible to finish this project. Finally, thanks to the university of Waikato for making all of this possible.



# Matakite

## A Virtual Reality Training Aid For Upper Limb Prosthesis Control

By Luke August  
Supervisor Dr Mahonri Owen

### Ma•ta•ki•te ['matə,kite]

Origin ~ Te Reo Māori

1. *Verb* ~ to see into the future, prophesy, prophesies, foresee, foretell.

2. *Noun* ~ a virtual reality training aid for upper limb amputees based in Te Ao Māori

### Problem

Arm prostheses are an important aid to function for upper limb amputees and assist in returning independence to their daily lives. A study conducted in 2020 found that across all levels of upper limb amputees, the rate of prosthesis rejection was 44%.

### Aim

The aim of this project was to develop a low cost, virtual reality training system for upper limb amputees which utilizes electromyography gesture commands.

### System Architecture

- 1) Hand Postures were modelled in Solidworks and rigged in Maya.
- 2) Rigged hands were imported into Unreal Engine.
- 3) EMG data is recorded using a Myoband.
- 4) Thalmic Labs Myo Plugin converts myo gesture data into hand postures in Unreal Engine
- 5) Hand changes to command posture in Unreal Engine



#### Papaki

*"To slap, spank, pat, clap, or strike together"*

*Hand posture - Relaxed*



#### Raranga

*"To weave harakeke fibres together for baskets"*

*Hand posture - Palmar Pinch*



#### Huti

*"To pluck the feathers from a bird"*

*Hand posture - Tripod Pinch*



#### Kumu

*"To strike with a clenched fist"*

*Hand posture - Fist*



#### Whawhaki

*"To pick the leaves from the kawakawa tree"*

*Hand posture - Lateral Pinch*

### Results

The current system has successfully implemented five different hand postures for the current prosthesis. However, physics interactions of the current system are rudimentary and meant to act as a proof of concept. Each hand posture is named after an action from Māori



### Conclusions

In conclusion, this system successfully functions as a proof-of-concept VR training device for upper limb prosthesis control. Further development on this project would include tracking the residual limb in 3d space, importing a selection of different prosthetic hands, development of a pick and place training module and implementing this system in a clinical trial.



# Scholarship Project:

## Sustainable 3D Printed Composites from Post-Consumer Plastics and Recycled Paper

This project focuses on the production of composites using recycled materials. We used various types of recycled plastic, made using materials such as milk bottles and ice cream containers, combined with recycled paper to make filament to use for 3D printing and testing.

### Main Goals of this Project:

- 1 Reliably produce composites using recycled materials.
- 2 Produce filaments and assess their quality and printability.
- 3 3D print various samples of different complexity and observe the results.



Project Researcher:

ETHAN COOKE

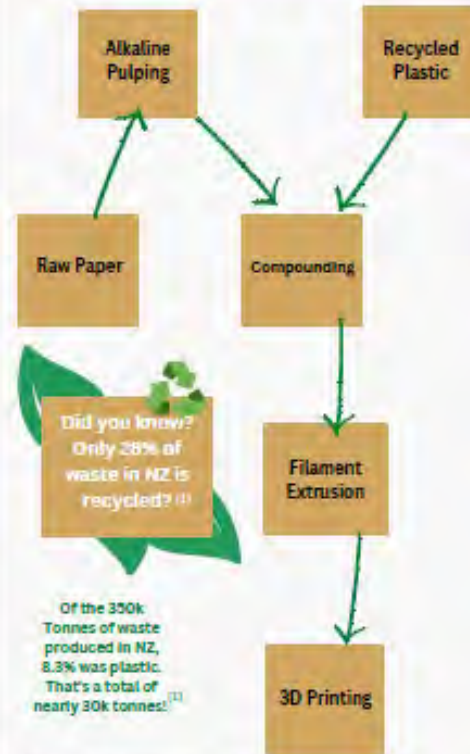
In Association with:



THE UNIVERSITY OF  
**WAIKATO**  
Te Whare Wānanga o Waikato

Supervisor: Mohammad Dalour Beg

## The Process of Production:



The entire process can be summarised in six steps:  
**Pulping**, the processing of raw paper via Alkaline solution.  
**Paper Fibre + Recycled Plastics**, in which raw materials are cleaned/prepared for the next step.  
**Compounding**, where raw materials are combined into a composite.  
**Extrusion**, in which a printable filament is produced.  
**3D Printing**, samples are printed.

Several tests are conducted on each formulation, based on the observations made and the stage reached before severe degradation of samples/filament.

## The Raw Material:



**Paper:**  
The raw fibre we use to make composite all comes from using recycled paper. It has short fibres and is very lightweight, with decent mechanical properties, it is produced using an alkaline solution.

### Milk Bottles:

Milk Bottles are a very common form of plastic waste. They are easy to recycle, low-density polyethylene with mechanical properties, but poor bonding and fibre compatibility.



### Ice Cream Containers:

Ice cream containers are made of a low density polypropylene. They have decent qualities and were a focal point of our process. For this project, the majority was taken from store-bought blue containers.

### PLA (Poly Lactic Acid):

PLA has been a very well-researched plastic in recent years. It is biodegradable, has good mechanical properties, and requires little effort to combine into a composite.



## Recycled Results:

Nearing the end of this placement, much of the testing conducted was related to recyclability. PLA proved to retain exceptional surface finish even after up to 3 recycles. This means that this material is both entirely biodegradable and retains most of its mechanical properties despite recycling.

## The Results:

### Mechanical Strength



### Filament



### Printability



### Overall



To judge which formulations were most appealing for continued research, we evaluated the products based on both mechanical and physical characteristics, including surface finish of filament, mechanical strength during testing, and how easy it was to print.

PLA formulations proved to yield the best results, being easy to compound and requiring no additives to do so, giving a smooth filament surface and printing with little difficulty. These qualities are also retained to a degree after multiple recycles, making it an ideal candidate for further investigation in future.



## BACKGROUND

Clustering data is imperative to identifying patterns within a dataset that may not be immediately obvious. It is a process of grouping similar data points together in clusters, with each cluster representing a unique group or subpopulation of the data.

This is illustrated below with simplified 2-dimensional dataset, illustrating the benefit of clustering.  $K$  refers to the number of clusters the dataset has been separated into, and  $r^2$  represents the accuracy of the solution.



As can be seen, the clustered data offers a more accurate solution and identifies a more intricate pattern to describe the plot.

The intention of this research paper is to quantify the Estimation Maximisation algorithm's ability to perform clustering, alongside testing the algorithm on real data sets to identify noteworthy patterns.

## APPLICATIONS

Clustered linear regression (CLR) is a powerful data analysis method that has the ability to identify patterns and relationships in data sets that may not be intuitively evident. Examples of useful applications of clustered linear regression are listed below:

### Market Segmentation

It can be used to help find relationships between customer characteristics and product purchases, accounting for location or demographic groups through clustering.

### Medicine

CLR can model the relationship between treatment and disease outcome, helping identify patient subgroups and improving medical prediction accuracies.

### Stock Exchange

The use of CLR would benefit stock exchange analyses, identifying strong relationships between stock prices and various economic factors.

## METHODOLOGY

MATLAB was used for data processing, plotting, and interpretation in order to quantify the Estimation Maximisation (EM) algorithm. This algorithm can be interpreted using the flow diagram below.

Using generated data and a known solution, various independent variables were altered to measure its impact on accuracy and iteration counts. Methods within the EM algorithm were tested in a similar manner.

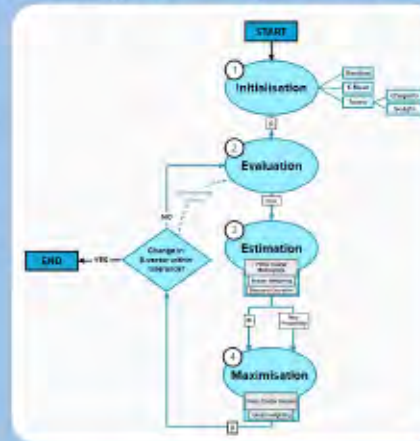
The tested independent variables and method categories is listed below.

### Tested Independent Variables:

Size of Matrix, Number of Clusters, Number of Data Points, Non-zero dimensions, Percentage Outliers, In Class Variance, Covariance, and Offset.

### Tested Method Categories:

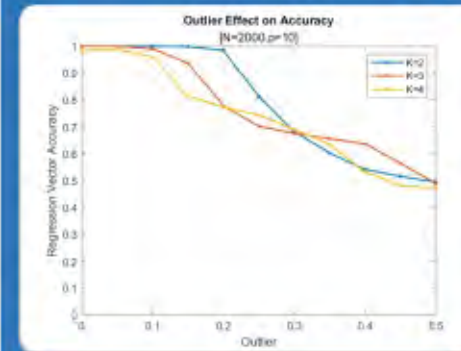
Data Trimming, Initialisation Type, Regression Method, Scale Estimate and Regression Weight, and Likelihood Distribution Function.



## RESULTS & DISCUSSION

Using this methodology, numerous tests were run to ascertain bounds to test within. Many graphs were produced and analysed for quantification purposes, under varying conditions and independent variables. Two examples of these analysed graphs are depicted below.

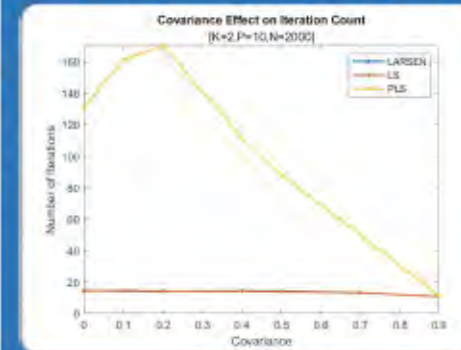
The EM algorithm was tested against the percentage outliers within the data. Outliers are data points that are significantly different from other points in the dataset, and this can significantly influence the accuracy and interpretation of the solution.



As depicted in the graph, there is a general decrease in accuracy of the solution whereby the lower  $K$ -values tend to be more accurate.

This is simply a graphical representation of the collected data, and inferences should be verified further.

Evaluations of the methods within the EM algorithm were also conducted. The following graph tests the regression methods against the covariance of the solution, being the angle between the solution vectors.



The LARSEN and LS techniques had near identical iteration counts, with covariance having little impact. The PLS technique required significantly more iterations to compute, and peaks at a covariance of 0.2.

A comprehensive examination of these graphical representations was carried out to quantify the performance of the EM algorithm. The results of this study will be disseminated in a publication to the academic journal for further elaboration.



# On the application of construction 4.0 to UG teaching

## Background

Industry 4.0 is driving an unprecedented transformation of global industries. Construction 4.0 is the construction industry's version of Industry 4.0 which represents the digitization of the construction industry.

## Problem

As the use of digital technology increases, what technologies can be used in undergraduate teaching of engineering?

## Method

The closest case study to ours is the expansion of the Science Engineering Workshop building (LSL building) in University of Waikato. The structural design for the extension was drawn by Waikato Steel Fabricators (WSF), who also used 3D scanning technology during construction.

To better see the structure of building in advance, VR technology has been used. In the meantime, since undergraduate students do not have much work experience, they may be confused when they first review 2D drawings, by using VR can help students expand their imagination faster.

## Conclusion

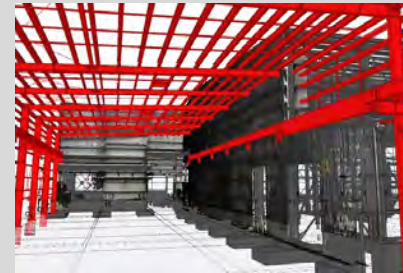
For buildings that have been built for a certain period of time, 3D scanning can more accurately confirm the location of each structure than comparing structural drawings. This saves time, reduces errors and rework.

The 3d Scanner APP can provide students with a simple 3D scanning experience.

Through the experience of using VR, it is found that this is very suitable for integration with courses. Due to the lack of practical experience of undergraduates, it is usually difficult for them to imagine what real construction structures look like. Using VR can help students stretch their imaginations faster to ensure they are fully prepared for the real work after graduation.

## Results

By using the 3D scanning technology to scan the original building and combine it with the extension structure can check whether the steel can be directly connected. Combination can be done by using Trimble-Connect.



An app called 3d Scanner APP can be used on iphone or ipad to do a 3D scanning anytime, anywhere. Although it is not as accurate as the laser scanner, it is very convenient. It can provide students with a simple 3D scanning experience.



To better understand the 2D drawing, in this project research, the use of VR technology is considered. Transfer the Cold-Formed Steel design drawn with FrameCAD to Revit, and finally upload it to the VR device to view the structure in person in the virtual environment. At the same time, scanning the QR code below can also be used to experience VR viewing with a mobile phone.



Design by Alice Liu

Supervised by Prof. James Lim, Dr Krishanu Roy

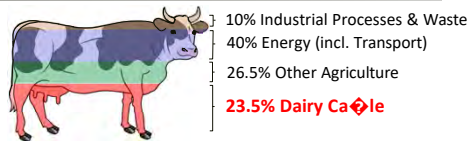
Acknowledgements to Petrus Barkowitz from Waikato Steel Fabricators, Prof. James Lim, Arthur Fang, Dr Krishanu Roy, University of Waikato Summer Research Program

# THE CARBON FOOTPRINT OF SYNTHETIC MILK

## PROBLEM

Of New Zealand's total greenhouse gas emissions in 2020, almost a quarter were from the **biogenic emissions of dairy cattle**, equivalent to **18 million tonnes of carbon dioxide**.<sup>1</sup> Finding **sustainable milk alternatives** has therefore become increasingly crucial.

### NZ's 2020 Greenhouse Gas Emissions<sup>2</sup>



## ALTERNATIVE

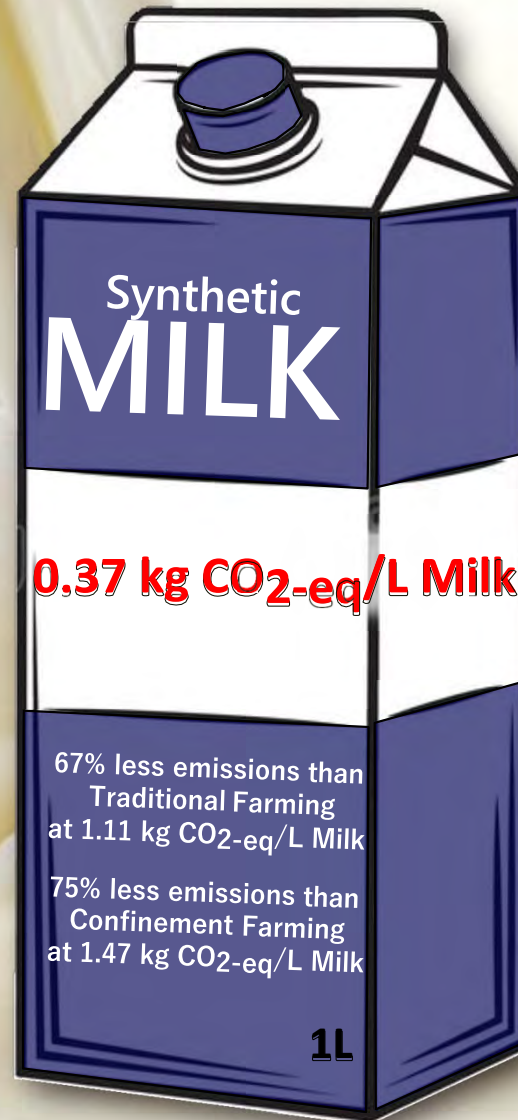
Synthetic milk is produced using **Precision Fermentation** - a technique that replicates the **six main milk proteins** making up **3.3% of normal cow's milk**.<sup>3</sup> This ensures the sensory and functional properties of milk are imitated when combined with table sugar, coconut fat, water, and calcium phosphate.

### Precision Fermentation



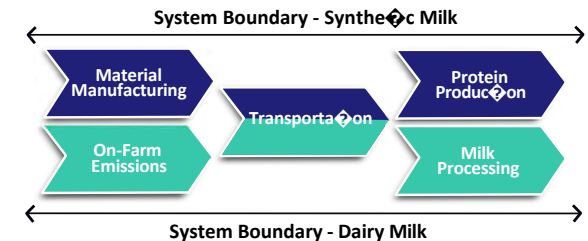
## AIM

To calculate the **carbon footprint of synthetic milk** compared to **traditional farming methods in New Zealand** as well as **confinement farming in Saudi Arabia**.



## METHOD

A **cradle-to-processing gate Life Cycle Analysis** approach was used with the functional unit being a **Litre of Milk**.



## RESULTS

Carbon emissions are based on an **industrial-sized bioreactor** with a **protein yield of 45 g/L** (as shown in the centre visual). Expressed using the **filamentous fungi, *Trichoderma reesei***, this reduces to **0.09 CO<sub>2</sub>-eq/L Milk** if the leftover fungal **biomass waste** is treated as **pet food**.

## CONCLUSION

The lower carbon footprint of synthetic milk reinforces its potential to **combat climate change**. Currently on shelves in the United States, there is a distinct possibility it will have a role in **New Zealand's future**.

## References

- Ministry for the Environment (2022). New Zealand's Greenhouse gas inventory 1990-2020. <https://environment.govt.nz/publications/new-zealands-greenhouse-gas-inventory-1990-2020/>
- Our World in Data (2021). New Zealand: CO<sub>2</sub> Country Profile. <https://ourworldindata.org/co2/country/new-zealand>
- Davoodi, S. H., Shahbazi, R., Esmaeili, S., Sohrabvandi, S., Mortazavian, A., Jazayeri, S., & Taslimi, A. (2016). Health-Related Aspects of Milk Proteins. Iranian journal of pharmaceutical research: IJPR, 15(3), 573-591.



# Harvesting the Potential of Natural Fibres

Author: Isobella Nicholls Supervisors: Dr Chanelle Gavin, Dr Rachael Tighe, Professor Kim Pickering (School of Engineering) and Professor Kura Paul-Burke (Marine Science and Aquaculture).



This project aims to investigate the physical properties of Harakeke (Flax, shown on the left) and Tī kōuka (Cabbage tree, shown on the right), to see how we can utilise their natural properties to reduce reliance on petroleum based plastics.

Our approach seeks to integrate mātauranga and kaupapa Māori throughout the project.



## Introduction and Terminology

Harakeke and Tī kōuka are woven into the fabric of New Zealand's history. They are invaluable plants, utilised in tools, clothing, and decorations. This project looks at these leaves and the natural fibres inside them.

Fibre is used to refer to fibre strands and fibre bundles. An individual fibre is called a single fibre. This is when you have a one strand, whereas strands and bundles are multiple fibres, which you could harvest from a plant with your hands.

## Objectives

This project has three objectives. This poster reflects the progress made towards the first two objectives.

- Establish the variation in the mechanical performance of fresh and fallen Tī kōuka and Harakeke leaves.
- Compare fibre strength following materials processing and traditional fibre treatment and characterise their morphology using microscopy.
- Quantify water uptake of fresh and fallen leaves and treated fibres within a marine environment and quantify any change in mechanical performance.



## Collection

In order to respect mātauranga Māori, traditional methods of collecting Harakeke and Tī kōuka were used. Associate Professor Kura Paul-Burke walked us through the process. Shown to the left is a source of Tī kōuka for this project, and above a source of Harakeke. This includes offering a karakia, to honour the sacrifice of the plant. For Harakeke, specific leaves from within the fan-like segments, as shown above, are harvested, to ensure the continuing health of the plant.

## Traditional vs Engineering Processing

To process the leaves for weaving, they are split into smaller strips, then a mussel shell or blunt knife is run over the leaf to soften it. This research compares this processing to chemical digestion with NaOH, an engineering method of processing fibres.

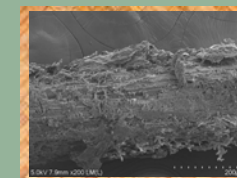
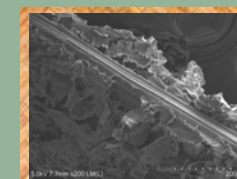
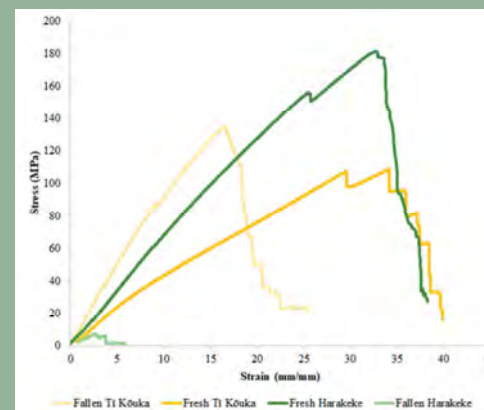
## Methodology and Results

In order to analyse the strength of the leaves, they were pulled until they broke using a tensile tester. This data can be affected by the moisture content (fresh vs fallen), which can be determined by weighing the samples before and after drying in an oven (data not shown).

Data collected so far has focused on the leaves, not treated fibres. The leaves are separated into thirds, base, middle and tip to assess if there are differences in strength and elasticity from different parts of the leaf.



The images above are of samples pulled on until failure, from left to right, dried Tī kōuka, fresh Tī kōuka, dried Harakeke and fresh Harakeke.



The graph above shows the stress versus strain of the middle section of all four leaf types (fresh and fallen, Tī kōuka and Harakeke). It shows the fresh leaves can be stretched further without breaking. Failure of the leaves is progressive with each drop in the data coinciding with an audible crack.

Fracture surfaces were examined using scanning electron microscope, fresh Harakeke and Tī kōuka samples shown in images above. This will be repeated with treated fibres and samples aged in a simulated marine environment to complete Objective 3.

## Future Work

The results collected so far include tensile test data, moisture contents, optical and scanning electron microscope images. The project is ongoing and as such more data will be collected before the final conclusions are drawn.

## Acknowledgements

I would like to acknowledge these people for their support with this project; Sophia Rodrigues, Jonathon Van Harselaar, John Akindoyo, Dr Dalour Beg, Helen Turner, and Associate Professor Michael Mucalo.

## Bibliography

Rowell, R. M. (2008). Natural fibres: types and properties. In K. Pickering (Ed), Properties and Performance of Natural-Fibre Composites (pp. 3-66). Elsevier Science. <https://books.google.co.nz/books?id=yFSkAgAAQBAJ>

Engineering, D. o. M. S. a. Fibers. Clemson University. <https://www.clemson.edu/cecas/departments/mse/research/areas/fibers.html>



# MECHANICAL COMPLIANCE IN AGRICULTURE

## What is *compliance*?

Compliance refers to the potential of a material or part to elastically deform; a compliant mechanism utilises this property to perform a specific desired action by bending.

## Why is bending better?

Compliant parts have many inherent benefits over their rigid-body counterparts:

- Lack of moving joints reduces friction and wear.
- Motion is very controlled and reliable (no backlash).
- Only a single part is needed, greatly reducing manufacture, installation and maintenance costs.
- Due to elastic energy being stored within the part material during use, the reverse motion is completed automatically, reducing the energy demand on external energy stores.

## Research objectives:

This research aims to understand compliant design principles and thereby develop functional kiwifruit gripper concepts that could serve as an end effector on an autonomous harvesting robot.

(Note: All research is part of an ongoing research project; Illustration is representative only, actual gripper designs are confidential.)

**Current**  
Labour shortages have led to the development of automatic fruit-harvesting vehicles, but they are difficult to prove. Compliant design aids and further

**problem:**  
Development of fruit-harvesting vehicles is currently not financially viable. Compliant design could hasten the development of these important machines and their affordability.

This poster makes use of the compliance of paper to fold into an interactive exhibit.

This text will not be seen

**How will it work?**  
The gripper will be fixed at the end of a robotic arm and a linear actuator will apply a force to one or both ends of the compliant fingers.

This force will deflect the ends of the gripper enough to enclose a kiwifruit allowing it to be picked by the robot.

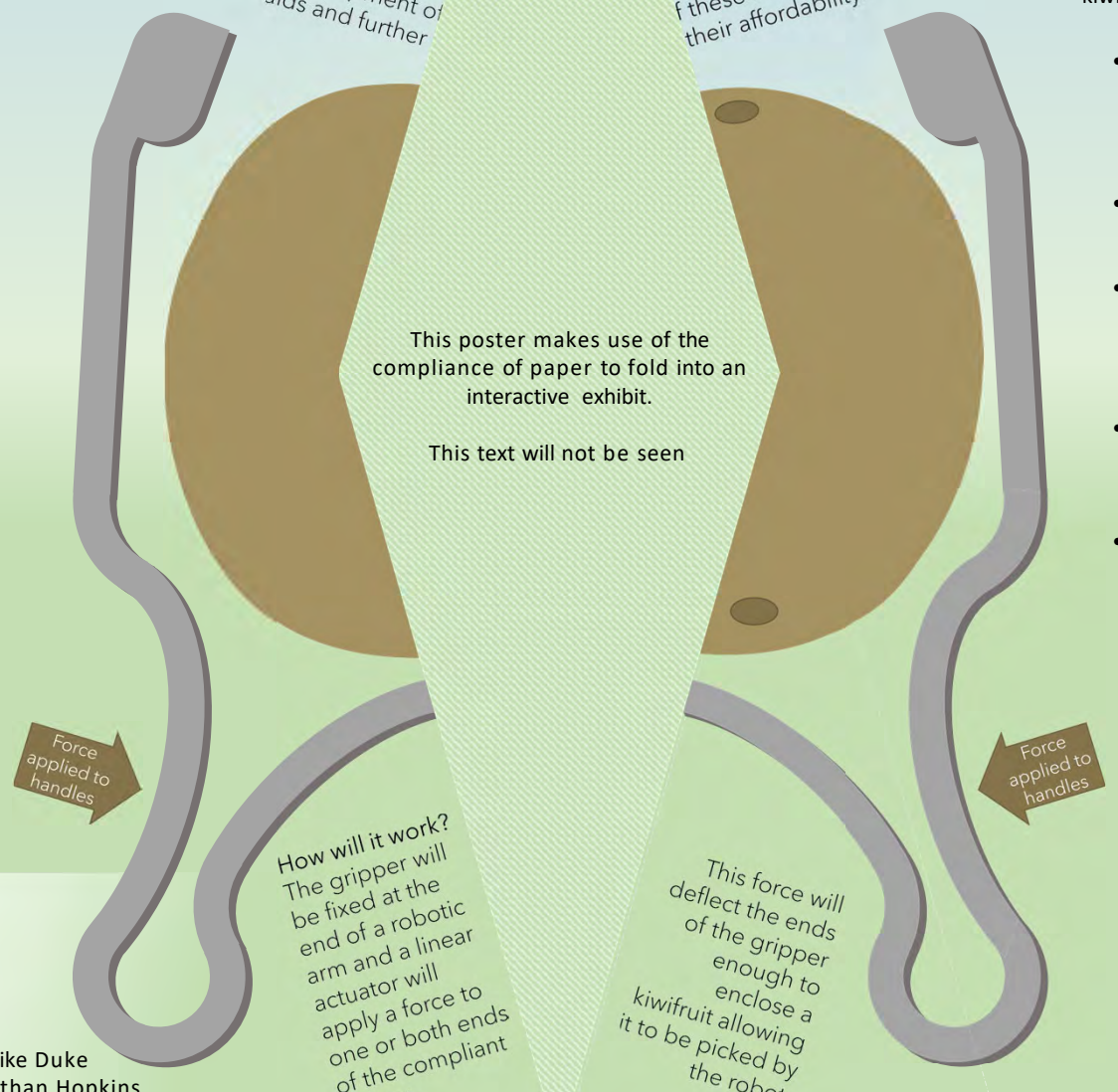
## Important design considerations:

Due to the single-part nature of compliant components, their design must incorporate every aspect of their intended use case. Below are some specific to a kiwifruit gripper:

- **Material:** Compliance, stiffness and tensile stress are important, as is fatigue limit because this part should be capable of thousands of stress cycles.
- **Profile:** Gripper should be slim enough to extract a single fruit from the bunches they grow in.
- **Desired motion:** This includes considerations for variation in fruit size, the angle at which fruit will be picked, actuation method and coupling techniques to attach to a robot.
- **Expected operational forces:** Every force experienced by the part will also impact the achieved finger displacement output by the gripper.
- **Manufacturing method:** every technique to produce the compliant part will introduce its own limitations, considerations, and costs.

## Expected outcomes:

Future research will aim to utilise this understanding of compliant design as it applies to kiwifruit grippers and produce prototypes that can be 3D printed out of metal. Titanium has the ideal material properties for such an application, and 3D printing could offer high-performance parts that can be quickly and effectively iterated upon or re-developed for each new use case.



Research completed by Jacob Redmond  
Under the supervision of Ajit Pal Singh and Prof. Mike Duke  
Thanks also to Ben Jackson, Larry Howell and Jonathan Hopkins



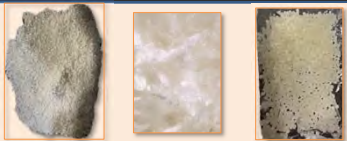


# 4D PRINTING WITH BIOMATERIALS

## Introduction

This project will focus on the processing and production of filaments using a blend of biodegradable thermoplastics and lyocell fibres for 4D printing applications. Filaments with different compositions will be 3D printed and used to assess the shape-changing potential after printing, e.g. 2D to 3D transformation in a predicted and controlled way. The effect of formulation and printing parameters will be evaluated and the optimum conditions will be used to design and print a prototype that can demonstrate the potential of this technology.

## Methodology



- PBS - Polybutylene succinate
- Lyocell
- PLA - Polylactic acid

Formulation ID	PLA content (wt%)	PBS content (wt%)	Fibre content (wt%)	Extrusion temperature (°C)
PLA	100	0	0	180
PBS	0	100	0	140
PLA/PBS20	80	20	0	180
PLA/PBS50	50	50	0	180
PLA-30L	70	0	30	180
PBS-30L	0	70	30	140
PLA/PBS20-30L	56	14	30	180
PLA/PBS50-30L	35	35	30	180

Formulations for compounding and filament production



Twin-screw extruder



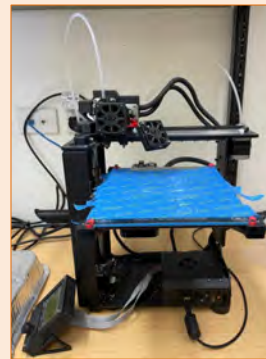
Filament thickness between 1.65mm to 1.75mm to facilitate printing



Single-screw extruder



Extruder temperature is between 180 to 210 degrees Celsius. Bed temperature ranges from 50-80 degrees Celsius



3D & 4D printing



3D printed samples were tested for their Young's modulus, strain rate and, tensile stress at maximum force



Tensile tester



4D printed sample

Active layer	Passive layer
1 PBS(70) L(30)	PBS/PLA(50)
2 PBS(70) L(30)	PBS(70) L(30)
3 PLA(70) L(30)	PLA(100)
4 PLA(70) L(30)	PBS/PLA(50)
5 PLA(70) L(30)	PBS(70) L(30)
6 PLA(80) PBS(20) L(30)	PBS/PLA(50)
7 PLA(50) PBS(50) L(30)	PBS/PLA(50)
8 PLA(70) L(30)	PLA(80) PBS(20)

Eligible formulations for 4D printing

### Characterisation methods

1. Scanning Electron Microscopy
2. Water swelling test

## Results

There are two layers which need to meet the requirements for the 4D printed sample. The first layer printed is the active layer, which bends while exposed to moisture. This is printed at 90° and is mainly the formulations which contain fibres mixed with the polymer blends. The layer printed on top of it is the passive layer. This layer provides stiffness to the sample which prevents it from breaking. This is printed at 0° and is mainly the formulations which contain a blend of just the polymers.

### Reference

TENCEL™ Lyocell – Albini 1876. (n.d.). Albini1876. Retrieved January 26, 2023, from <https://www.albini1876.com/en/tesuto/tencel-lyocell/>

## Conclusion

This study shows a potential advanced method of deforming materials and bringing them back to their original shape. This could lead to innovative new inventions such as a folding table or chair. This can even be used as a potential form of flat packing, hence increasing storage. These innovative methods can be useful in the future whilst being environmentally friendly.

# Modelling Fuel Costs for Industrial Boiler Applications

## Background

Industrial & commercial boilers are frequently used across many of New Zealand's primary industries, including:

- Dairy manufacturing
- Wood, pulp & paper processing
- Meat products

The energy these boilers deliver is critical to many manufacturing processes, converting raw materials to high-value manufactured goods.

## Problem

Determining which type of boiler is best-suited for a commercial or industrial operation is difficult. Many factors affect this decision:

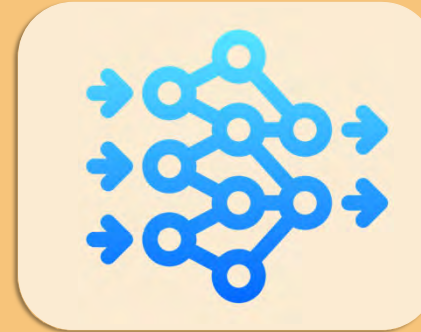
- Expected boiler size
- Average load
- Geographical region

Determining the anticipated cost of operating a boiler is highly specific to the operational context.



Input Data

## Perform Calculations



## Development

To design and develop a prototype web tool to predict the type of boiler best-suited for a given industrial plant, based on expected environment & operating conditions.

This tool will be free-to-use and highly accessible. Usability and a simple user experience should be prioritised.



Produce Results

## Present Recommendations



## Outcomes

A two-part prototype has been developed, featuring:

- Intuitive user interface
- REST model based backend API

Opportunities exist for future improvement of this tool, including:

- Expanding the complexity of calculations
- Allowing users to permanently save results

By Harrison Whiting

Supervised by Dr Tim Walmsley & Dr Isuru Udugama

Acknowledgements to Dr Martin Atkins & Stephen Burroughs

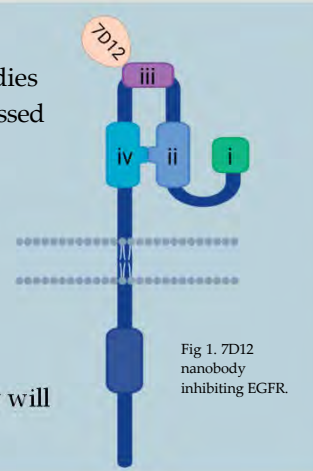


## Background

7D12 is a single-domain antibody fragment (nanobody) derived from camelid antibodies that inhibits epidermal growth factor receptor (EGFR) proteins, which are over-expressed in cancer cells.

Our team is interested in developing nanobody drugs like 7D12, without biological synthesis. We are currently investigating a novel technique called 'Flow-Assisted Chemical Synthesis', which has the potential to rapidly synthesize nanobodies on a large scale.

The chemical synthesis process, however, leaves proteins in a denatured state and they will need to be folded correctly before they can be used.



# REFOLDING OPTIMIZATION OF ANTI-CANCER NANOBODIES

Kevin Beijerling, Jared Kelsen and William Kelton  
Te Huataki Waiora School of Health | University of Waikato



## Obectives

The aims of this project were to:

- Develop an optimized protocol for refolding denatured 7D12 nanobodies.
- Produce biologically synthesized nanobodies in bacterial and mammalian cells to compare with chemically synthesized ones.

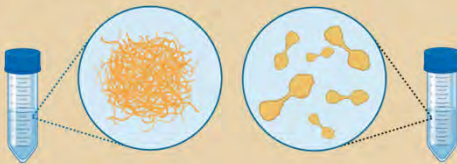


Fig 2. An example of denatured (left) and functional (right) nanobody proteins.

## Methods & Results

### Nanobody Purification

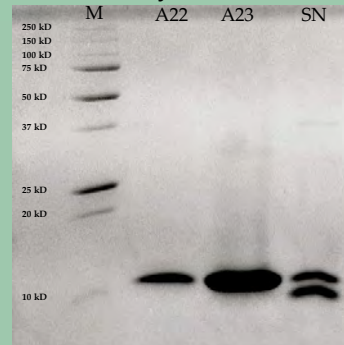


Fig 3. SDS-PAGE of 7D12 nanobody samples purified using high-pressure liquid chromatography (HPLC). Gel indicates possible presence of monomeric and dimeric 7D12 samples.

- Bacterially synthesized 7D12 samples purified via HPLC.

### Refolding Screen

#	Buffer	Salt	PEG 3350	Maltoside	GuHCl	Polarity	Redox
1	50 mM MES pH 6.5	10 mM NaCl	0.05%	0.3 mM	500 mM	0 mM	1 mM GSH, 0.1 mM GSSG
2	50 mM MES pH 6.5	10 mM NaCl	0.05%	0.0 mM	500 mM	200 mM Sucrose (NP) 200 mM L-Arg (P)	1 mM GSH, 0.1 mM GSSG
3	50 mM MES pH 6.5	250 mM NaCl	0.05%	0.0 mM	0 mM	200 mM Sucrose (NP)	1 mM GSH, 0.1 mM GSSG
4	50 mM MES pH 6.5	250 mM NaCl	0.05%	0.3 mM	0 mM	200 mM L-Arg (P)	1 mM GSH, 0.1 mM GSSG
5	50 mM Tris pH 8.2	10 mM NaCl	0.05%	0.3 mM	0 mM	200 mM Sucrose (NP)	1 mM GSH, 0.1 mM GSSG
6	50 mM Tris pH 8.2	10 mM NaCl	0.05%	0.0 mM	0 mM	200 mM L-Arg (P)	1 mM GSH, 0.1 mM GSSG
7	50 mM Tris pH 8.2	250 mM NaCl	0.05%	0.0 mM	500 mM	0 mM	1 mM GSH, 0.1 mM GSSG
8	50 mM Tris pH 8.2	250 mM NaCl	0.05%	0.3 mM	500 mM	200 mM Sucrose (NP) 200 mM L-Arg (P)	1 mM GSH, 0.1 mM GSSG
9	1 x TBS						

Table 1. Concentrations for 7D12 nanobody refolding screen buffer conditions.

- Dialysis protocol was developed and executed using denatured 7D12 nanobodies in eight different refolding buffers.

### Mammalian Cloning

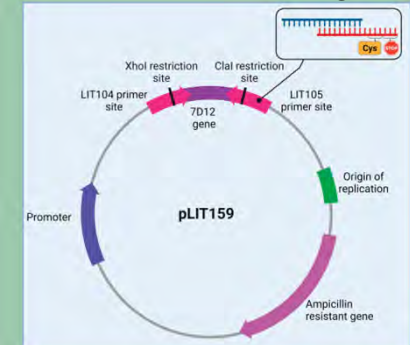


Fig 4. Plasmid map of pLIT159 for mammalian transfection showing PCR primer and restriction enzyme sites.

- PCR primers were designed for cloning C-terminal cysteine into the mammalian plasmid for conjugation.

## Conclusion

We have successfully synthesized and purified 7D12 nanobodies from bacteria to use as a positive control for chemical synthesis, and developed a screen to test for optimized refolding conditions.

Our next steps are:

- Perform a functional assay to test refolded nanobodies.
- Clone and transfect 7D12 plasmid into mammalian cells to produce conjugatable nanobodies.

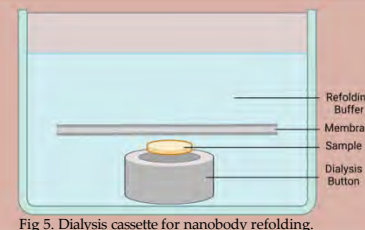


Fig 5. Dialysis cassette for nanobody refolding.

## Acknowledgments

A special thanks to Dr Willaim Kelton for his enthusiastic guidance, and to the Maurice Wilkins Centre for Molecular Biodiscovery for funding this project.



# Diabetes Education for Health Care Professionals



THE UNIVERSITY OF  
**WAIKATO**  
*Te Whare Wānanga o Waikato*

Created by: Kristina Campbell  
Principal Investigator: Dr. Ryan Paul (University of Waikato)  
University of Waikato Summer Research Program

Type 2 diabetes (T2D) affects approximately 300,000 New Zealanders. T2D occurring alongside Cardiovascular and Renal Disease Complication, has created health inequities among Māori and Pacific peoples that have T2D - leading to a shorter lifespan.  
How can we help?

## STUDY:

Major barriers for Health Professionals to effectively prescribe in patients with T2D in primary care setting include:

How do we plan on overcoming these barriers?

- Adequacy of training
- Time for decision making
- Education
- Increased communication with diabetes specialists

## Primary Objective:

Determine a favoured form of diabetes education in primary care

## DESIGN:

Single site randomised controlled crossover study

Complete online standardised self-efficacy survey of diabetes management at:

- Start
- Halfway
- Completion of study

8 x 30-minute participant-led case-based learning

- Control group: Crossover to receive same mentoring intervention

8 x 30-minute webinars, then:

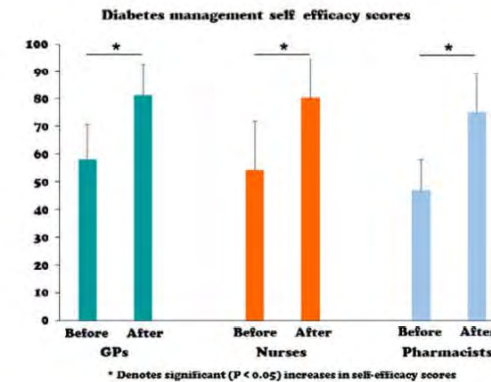
- Intervention Arm: Online Mentoring
- Control Arm: No Intervention

## FINDINGS:



### Preferred Forms of Diabetes Education:

- 61% of Registered Nurses (RN) prefer Live Webinars
- 38% of General Practitioners (GP) prefer Recorded Webinars
- 33% of General Practitioners (GP) prefer Live Webinars
- 56% of Pharmacists prefer Case-Based Mentoring



Ethnicity Demographics:  
45 x European  
17 - Maori  
2 - Pasifika  
7 - Indian  
5 - Chinese  
5 - Others

Demographic Genders:  
Female - 54  
Male - 24  
Gender Neutral - 3

21 - GPs  
46 - Registered Nurses  
9 - Pharmacists  
5 - Others

## CONCLUSION:

Live webinars are the most preferred form of diabetes education in Primary Care, but education needs to be individualised with many preferring Recorded Webinars and Case-Based Education.

Factors that were important in this preferred form of education were:

- Increased clinical discussion with specialist
- Ability to pause/rewatch session



# Production and Generation of Therapeutic Nanobody 7D12: (Bacterial Expression)

Waikato Student: Jared Kelsen BSc(Tech): Molecular Biology.

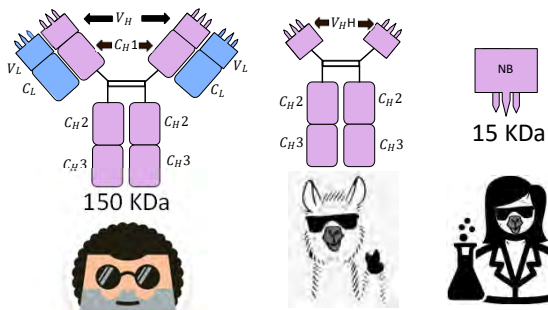
Supervisor Prof. William Kelton

In collaboration with The University Of Auckland and The Maurice Wilkins Centre

## AIM

- Make protocols for producing nanobodies.
- Use transformation to make 7D12 Nanobody.
- Purify 7D12.
- Prove function of 7D12 by binding to EGFR (receptor for cell growth).
- Provide The University Of Auckland with functional 7D12.

## What Is a Nanobody



- Large standard antibodies use CH1,CL,VL,&VH.
- Camelid antibodies work with just the VH.
- Nanobodies are the VH taken from camelids.<sup>1</sup>

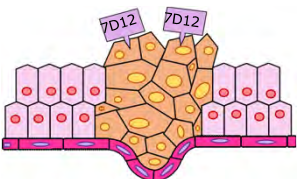
## What Can Nanobodies do?



Disease Screening



Vaccines

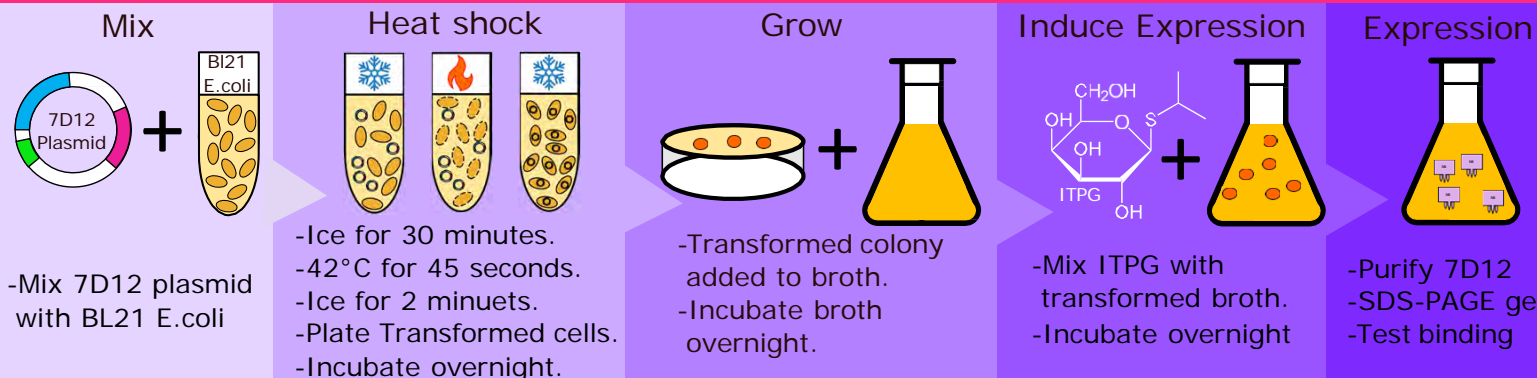


Cancer Treatments

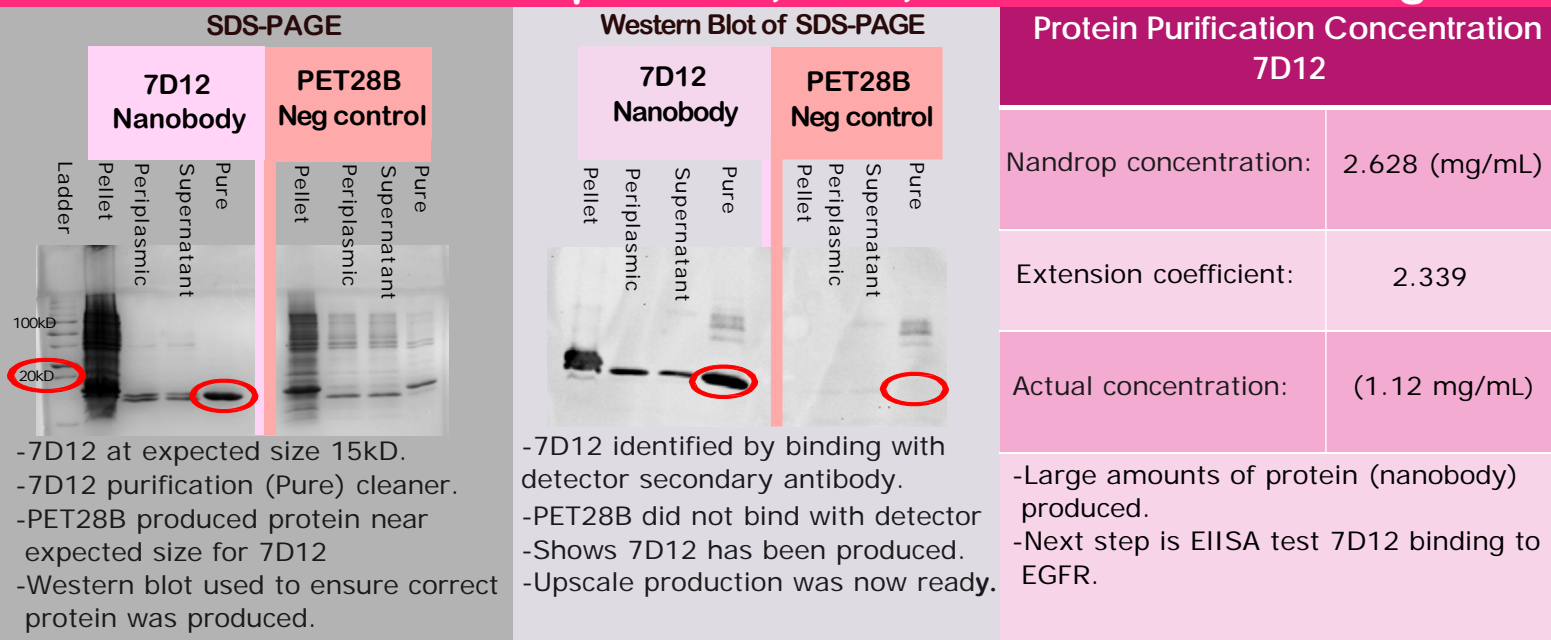


Faster Drug Delivery

## Generation of 7D12 Nanobody



## Results for 7D12: Expression, Gels, Purification & Binding



## Conclusion

Protocols for the production and purification of the 7D12 nanobody were successful. Testing for binding to EGFR has not happened yet, but once the reagent arrives it will be done. If ELISA is successful, then enough nanobody has already been produced for The University Of Auckland. The project is on track for completion by the end date.

# The holistic needs of Maaori patients living with Chronic Obstructive Pulmonary Disease.

## Why this is important...

- Maaori patients with Chronic Obstructive Pulmonary Disease (COPD) are experiencing poor health outcomes and multilevel barriers when accessing health care (Hopley et al. 2009).
- Understanding the impact of wider determinants of health such as housing, income, social environments and access to health services is important.
- Maaori understandings of health and wellbeing are integral to improving outcomes.

By Maaori, for Maaori.



## Our answer?

The Hauora Needs Assessment tool (HNA)



- A comprehensive survey to assess the unmet health needs of patients with COPD.
- Needs assessed in the HNA include housing and income, mental health and broader range of health determinants.
- The HNA includes an extensive list of referral pathways to ensure unmet needs are met fully and comprehensively.

Research by Wallis Malcolm.  
Supervised by Ross Lawrenson,  
Amy Jones and Haylee Simon.

## Co-Design Methodology:

"Co-design is a method for partnering with patients, consumers and service users right from the beginning of service planning to ensure a closer alignment of service delivery with what will work best for service users" (Health Navigator, 2021)

01 We began consultation with key stakeholders in community health: community health providers, hospital care providers (both in-patient and out-patient), health support programmes and whaanau living with COPD. **The HNA is 'Co-Designed'.**



02 Focus groups were held with Maaori patients living with COPD. These hui allowed us to hear the voices and opinions of the people we are trying to help. Their experiences and knowledge are integral to fully understanding the effects that COPD has on whaanau, as well as further understanding their holistic needs.



03 Using feedback from our focus groups, we were able to further develop the HNA tool to better suit the needs of our target group! This work continues the co-design method.



04 A pilot will test our HNA tool and its effectiveness at assessing holistic health needs, and current gaps in care. We are aiming for 50 patients to participate in the trial of the HNA tool.



## Key Findings from focus groups:

- Having whaanau be supported and informed is important, in order to live well with COPD. *"The more our whaanau get involved, the easier it is for us... They see the signs we don't"*
- Trust and respect are integral in relationships between patient and healthcare workers. *"It's like anything you know, we want to be respected."*
- The HNA tool and its delivery needs to be flexible. Patients need to be in a comfortable and safe environment. *"I don't think the hospital is the right environment... it has to be an environment where they feel safe"*
- Maaori health and wellbeing are holistic and composite. *"We've got to combine the whole lot together... And that will help us. The wairua will come out and fill our tinana up."*

## Conclusion:

Maaori living with COPD face a complex range of challenges. Ensuring their health care is flexible, comprehensive and culturally responsive is the solution for better health outcomes. This research has the potential to impact health care at multiple levels including regional health management and community-based agencies, together with patients and whaanau. It will also provide a framework for the Ministry of Health and other entities that are tackling the health equity gap.



# Exploring Prescribing Pharmacist Views on Type 2 Diabetes Management in the Waikato

Valentina Papa, Kimberley Norman, Shemana Cassim, Lynne Chepulis

Medical Research Centre, University of Waikato, Hamilton; Te Whatu Ora, Hamilton



## Background

Type 2 diabetes (T2D) is a global epidemic affecting over 290,000 New Zealanders, including a disproportionate number of Māori and Pacific. These inequities have not improved in the last 20 years, illustrating the need for new methods of prevention, early recognition, and management of T2D. Evidence shows that prescribing pharmacists in primary care can positively contribute to humanistic and clinical outcomes in patients with T2D by allowing patients to gain a better understanding and adhere to medication regimes. Furthermore, prescribing pharmacists can optimise medications, improve patient safety, and increase access to appointments and prescriptions in a timely manner. Therefore, this study aimed to explore prescribing pharmacists' views on current T2D management.

## Methods

Qualitative interviews were carried out via zoom with 6 female prescribing pharmacists in the Waikato Region; inclusion criteria was that participants were current pharmacist prescribers. Waikato general practices and Māori health providers were contacted via phone and email and were invited to participate. Participants were asked about their experiences with managing patients with T2D. Audio-recorded interviews were transcribed and thematically analysed.

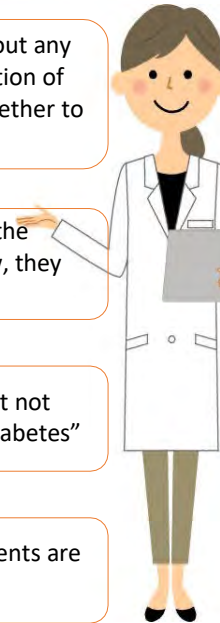
## Participants Experiences with Managing Patients with T2D

"Often patients are prescribed medications without any explanation of the pathophysiology of the condition of how the medicines are helping how they work together to help"

"The clinicians in this practice are great, but the management isn't conducive, I guess... You know, they don't they don't understand equity"

"The GP model of 15-minute appointment is just not conducive to managing a condition like type two diabetes"

"We [health practitioners] are not open when patients are available"



"Having a mobile pharmacist to go and see them [patients] would be ideal because that then takes away some of the access issues"

"The language that I use is usually really positive. And I use 'we' all the time... So it's not putting the whole thing on the patient"

"Honestly, people are very sharp, if they're enabled or they're empowered to be able to self-manage"

"...we received feedback from the GPs to their colleagues about how useful it's been having us..."

## Conclusion

Overall, the main themes identified in this study were *broken system*, *team approach*, *education*, *stereotypes*, *tailored approach*, and *inequity reduction*. One of the main factors affecting T2D management was poor communication between HCP and patients. Additionally, short appointment times also acted as a barrier in patients' understanding of diabetes and how medication works. Thus, incorporating prescribing pharmacists into primary practice teams would allow for greater access to diabetes care, improved patient education, and inequity reduction.

## Acknowledgements

We would like to acknowledge and thank the University of Waikato Summer Research Scholarship Program, the Health Research Council, Dr Shemana Cassim, Dr Lynne Chepulis, Kimberley Norman, and Professor Ross Lawrenson.



## Background

*Neisseria gonorrhoeae* causes the sexually transmitted infection, gonorrhoea. It has been listed as a high priority pathogen by the World Health Organisation due to posing a major threat to human health and has developed resistance to every antibiotic used to treat it since the 1930's. [1]

There is currently no vaccination, treatment relies solely on antimicrobial therapy. There have been reports of decreased susceptibility to the current recommended therapy, azithromycin and ceftriaxone, in the Waikato and Auckland area. [1]

## Project Aim

Perform antimicrobial resistance testing and genomic analysis to better understand the antimicrobial resistance of *N. gonorrhoeae* isolates from the Waikato and Bay of Plenty regions.

## Samples

Thirty-one samples were provided by pathlab from patients in the Waikato and Bay of Plenty regions between September 2022 and January 2023. Patient location, age, gender, and ethnicity (when disclosed) were provided.

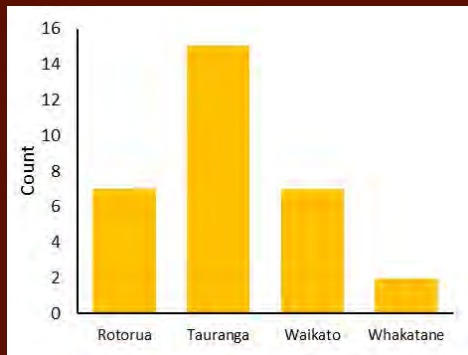


Figure 1: Patient location

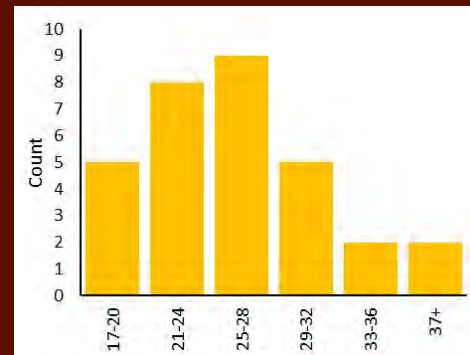


Figure 2: Patient age

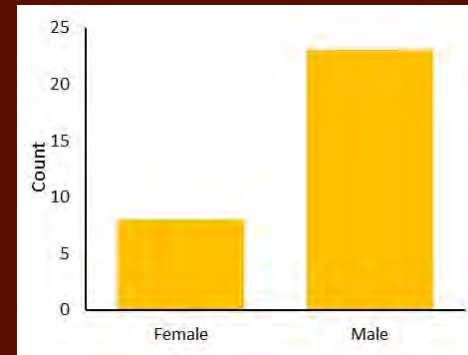


Figure 3: Patient gender

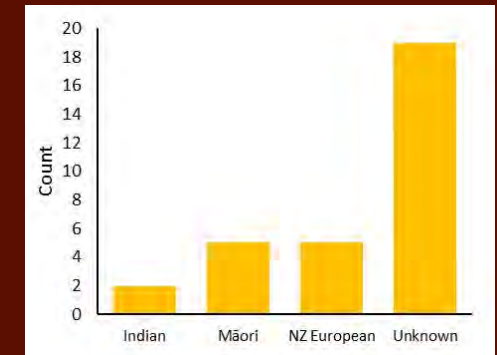


Figure 4: Patient ethnicity

## Next steps

- DNA extractions have been optimised for *N. gonorrhoeae* and whole genome sequencing for each sample using Oxford Nanopore Technologies' MinION is in progress.
- Antimicrobial resistance testing using the ETEST method is in progress
- Analysis of results from antimicrobial resistance testing and genomic data.
- We expect to see isolates from the same areas to have similarities in their antibiotic resistances and resistance genes.
- We are also curious if we are able to create a phylogeny from the sequenced isolates to help understand transmission of infection

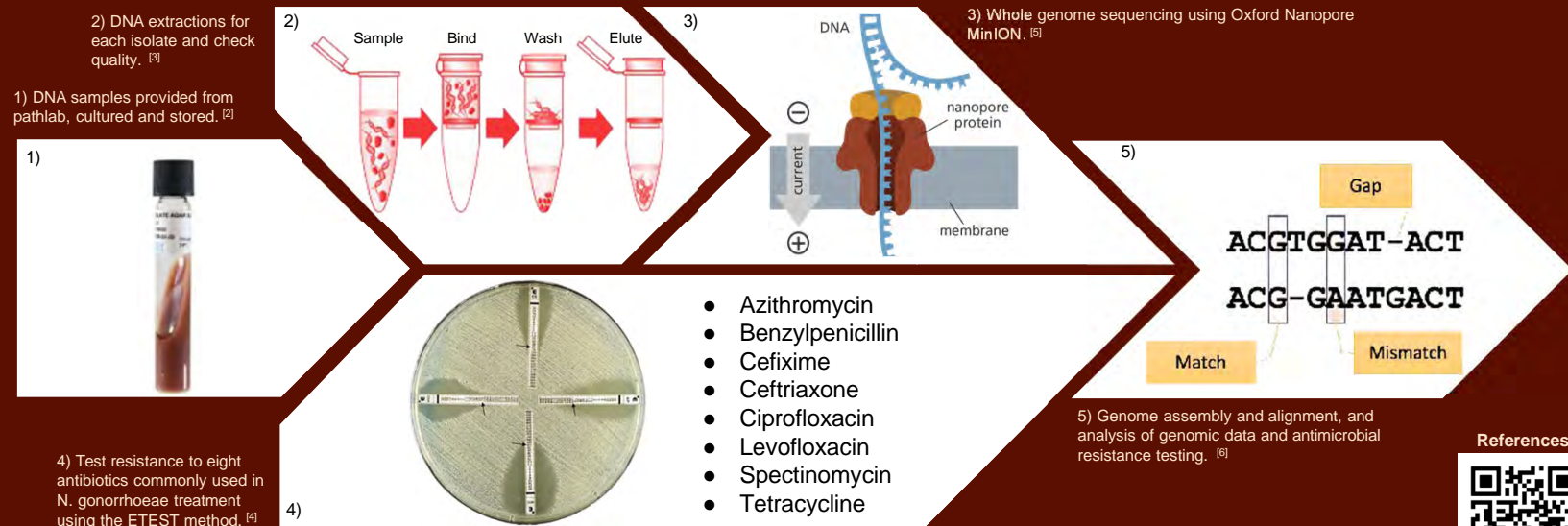


Figure 5: Overview of next steps in the project







## Use of coercive interventions in New Zealand Mental Health Services

Ivone Tavares and Anthony O'Brien - University of Waikato, Te Huataki Waiora, School of Health, Hamilton

### Background

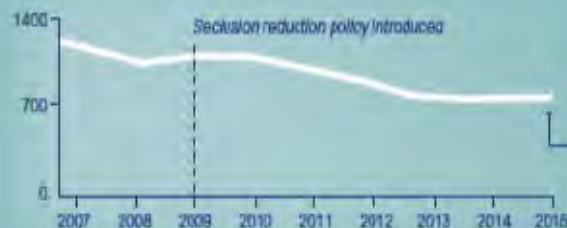
Coercive interventions like seclusion and community treatment orders (CTO's) have been used in the management of the population mental health disorders over centuries<sup>1</sup>. Commentators have described (2004) the use of CTO's exist more to "reassure public than for therapeutic reasons and their stigma and coercive impact are common concerns"<sup>2</sup>. In recent years, with a view to improve and regulate the use of restrictive measures in New Zealand health care settings, a seclusion reduction policy was introduced in 2009<sup>3</sup>. This was instigated by health care professionals, researchers and services users (patients). This study was designed to explore the relationship between seclusion and use of mental health legislation.

### Methods

The New Zealand Ministry of Health provided data on seclusion rates and data on the use of CTO's. Every year data is presented in an annual report (Office of the Director of Mental Health and Addiction Services). Data were extracted from these annual reports, per 100,000 population from 2006 to 2021 and by district health boards (DHB). Data were entered on an excel spreadsheet for analysis. The Pearson correlation coefficient was used to investigate relationships between rates of seclusion and use of mental health legislation.

### Results

**Seclusion<sup>3</sup>**  
in mental health services  
has been declining  
since 2009



### Section 29

in mental health services  
have been increasing since 2009



Figure 1  
Rate of people subject to sections 11, 29, or 30 of the Mental Health Act, by DHB, per 100,000 population from 2006 to 2020

Use of seclusion is strongly related to use of mental health legislation, with correlations of  $r=.80$  (section 11) and  $.76$  (section 29).

### Conclusion: Finding a new way

Health districts that have high rates of use of mental legislation also have higher rates of seclusion, suggesting that some districts are significantly more coercive than others. Initiatives that aim to reduce use of coercion may need to be targeted at those districts where the rates of coercion are higher. Further research is needed to understand factors that may account for different rates of coercion.

### References

1. Colizzi, I. (2005). Seclusion & restraint: A historical perspective: [1]. *Journal of Psychosocial Nursing & Mental Health Services*, 43(2), 31-37. doi: <https://doi.org/10.3928/02793695-20050201-07>
2. Romans, S., Dawson, I., Mullen, R., & Gibbs, A. (2004). How mental health clinicians view community treatment orders: a national New Zealand survey. *The Australian and New Zealand journal of psychiatry*, 38(10), 836-841. <https://doi.org/10.1080/1440-1614.2004.01470>
3. Ministry of Health 2017; Standards New Zealand 2008a,b
4. Section 11 requires patients to undergo further assessment and treatment for 5 days.
5. Section 29 requires patients to comply with psychiatric treatment outside hospital and authorises the patient's rapid return to hospital, with police assistance if required.
6. Section 30 requires continued detention of the patient in the hospital.
7. *Man in hospital pushing closed medicine* [Photograph]. Shutterstock (Image. <https://www.shutterstock.com/image-photo/man-hospital-pushing-closed-medicine-529643491>)

### Acknowledgements

We would like to acknowledge and thank the University of Waikato Summer Research Scholarship Program.





# HOW DO BACTERIAL PATHOGENS OBTAIN SULFUR FOR INFECTION?

Jessica Usu, Supervised by: Dr. Joanna Hicks, Keely Oldham & Jack McGarvie

## INTRODUCTION

The World Health Organization has described antibiotic resistance as a leading global health crisis due to the emergence of antibiotic resistant strains<sup>1</sup>. This means it is imperative that we identify novel targets for drug development purposes. One such target is the cysteine biosynthesis pathway due to cysteine being crucial for infection and protection from oxidative stress in a host<sup>2</sup>. This project looks at the last step in this pathway (fig1) and seeks to characterize a Cysteine Synthase complex (CSC) enzyme from *E. coli* (Ec) made up of serine acetyltransferase (CysE) and O-acetylserine sulfhydrylase (CysK). Currently there is no solved 3D structure for CSC, and it is still unknown how the bienzymatic proteins CysK and CysE bind. Fig1 illustrates two possible binding confirmations of these enzymes.

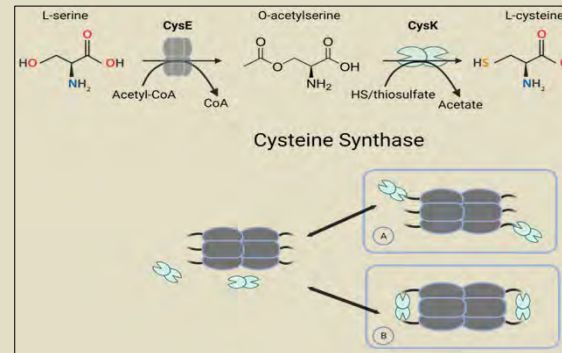


Fig1: Cysteine biosynthesis pathway and possible CSC binding

## RESULTS

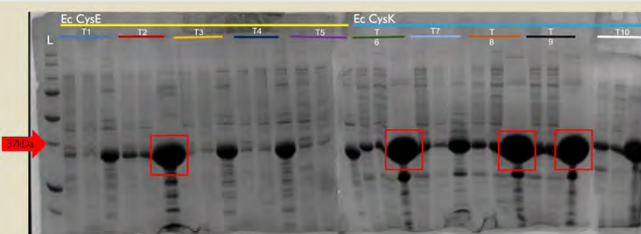


Fig3: Expression trial of EcCysE and EcCysK, L=protein ladder, T1-T10 are the various test conditions. The large blots highlighted in red indicate increased protein yield, where no glucose was added.

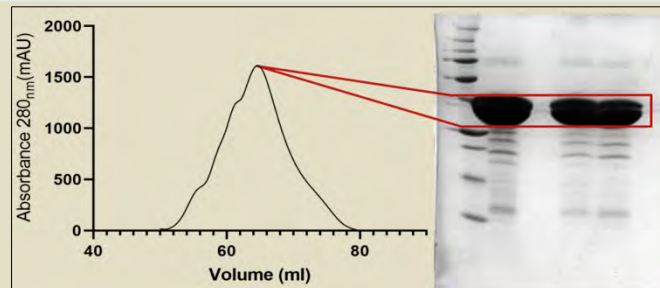


Fig4: Chromatogram of CSC formed, highlighted in red and confirmed by SDS-PAGE (right). The dark bands indicate two distinct bands on top of each other the complex! EcCysK and EcCysE where pooled together then run through gel chromatography.

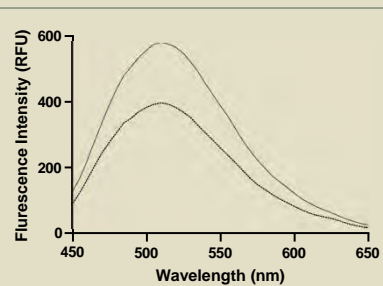


Fig5: CSC fluorometry test upon excitation at 412nm collected between 429nm and 650nm. Solid line CysK only and dashed line 1:1 ratio CysK : CysE. The results seen were not expected as the addition of CysE should have increased the fluorescence intensity and not decrease it as seen here.

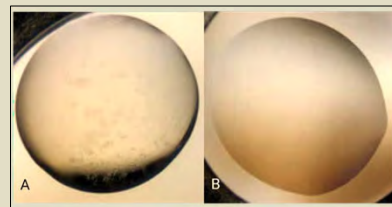


Fig6: Crystal drop conditions A, indicating precipitation of protein suggesting protein concentration too high and B indicating possibly good conditions. Crystal screens requiring 2-3weeks to grow.

## METHODS

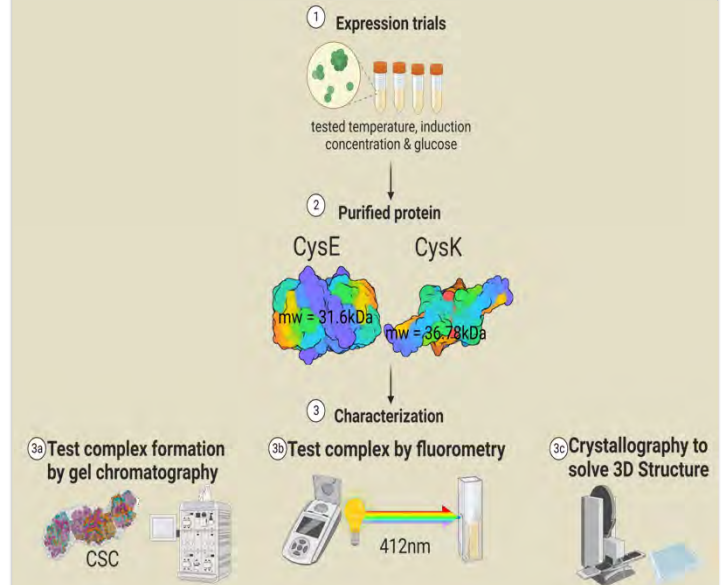


Fig2: Summary of project methods. Expression trials tested optimal protein yield conditions by varying temperature, IPTG induction concentration and glucose. Purified protein was used to test CSC formation by gel chromatography and established methods<sup>3</sup> of fluorometry. Concentrated CSC used for crystallography in an attempt to solve the 3D structure.

## DISCUSSION & FUTURE WORK

- Expression trials were optimized and produced increased protein yield in *E. coli*
- CSC formation was confirmed by gel chromatography and confirmed with SDS-PAGE analysis.
- Previous fluorometry studies<sup>4,5</sup> have stated that the addition of CysE to CysK, excited at 412nm should show an increase in peak intensity sometimes accompanied by a blue-shift that confirms complex formation. This was not seen in my experiments and so more optimization needs to be carried out.
- Following optimization of fluorometry experimentation this work will form the positive control that can then be replicated in other CSC pathogenic bacteria.

### Acknowledgements:

Thank you to Dr. Joanna Hicks, Keely, Jack and the University of Waikato Summer Research program



## Do *Nothofagus* and podocarp-broadleaf stands differ in leaf area index and understorey light?

M.O.A Atatoa Carr, C.H Lusk (Environmental Research Institute)

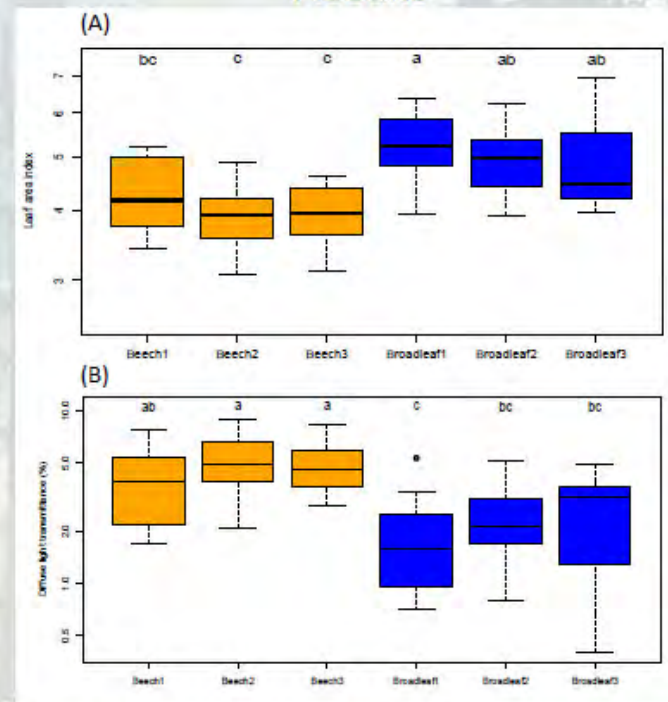
### Introduction

- New Zealand beech (*Nothofagus*) forests are floristically poorer than neighbouring podocarp-broadleaf forests, and have a less complex vertical structure. This may reflect exclusion of some species by short-circuiting of the local nitrogen cycle by the ectomycorrhizal fungi associated with *Nothofagus* tree roots.
- We hypothesized that these differences in structure and composition would result in *Nothofagus* stands having lower leaf area indices (LAI) than podocarp-broadleaf stands growing in similar environments, and hence greater light transmittance to the understorey.

### Methods

- Carried out at Rocky Hill, eastern Wairarapa.
- LI-COR LAI-2200C Plant Canopy Analyzer used to compare leaf area index and understorey light in three *Nothofagus* and three podocarp-broadleaf stands, growing on soils differing minimally in pH, total phosphorus and total nitrogen.

### Results



**Fig 1.** Average LAI (A) and understorey light (B) differed significantly across the six stands (ANOVA,  $P < 0.0001$ ). Stands sharing the same letter are do not differ significantly according to Tukey's HSD test.



**Fig 2.** *Nothofagus* stand (left) and podocarp-broadleaf stand (right), at Rocky Hill, eastern Wairarapa.

### Conclusions

- Leaf area index of *Nothofagus* stands averaged one unit lower (~4) than that of podocarp-broadleaf stands (~5). Light availability under *Nothofagus* (4.1 to 5.4 %) was twice that beneath podocarp-broadleaf stands (1.9 to 2.6 %).
- The data supports our hypothesis that the simpler structure and lower diversity of beech stands reduces stand leaf area index.

### Acknowledgments

- RSNZ Marsden grant 20-UOW-041 to CHL
- UOW Summer Research Program





Figure 1. **1A.** *Calochilus robertsonii*. **1B.** *Thelymitra nervosa*. **1C.** *Adenochilus gracilis*.

## Orchid Distributions at Iwitahi Native Orchid Reserve

### Introduction

The only New Zealand reserve dedicated to native orchids is situated in Iwitahi in an aging *Pinus nigra* stand; a pine species known to provide good habitat for NZ orchids.<sup>1</sup> The canopy of the reserve is deteriorating as the pines get older, and a proposed solution to this problem is to change the reserve's location. This study surveyed the orchid distributions in *P. radiata* stands near the reserve to assess whether they present an option for continuing the reserve.

### Methods

30 stands were selected for surveying in this study, by stratifying stands near the reserve by age and randomly selecting five stands from each age class. Data was collected by recording orchids found while walking within and on the edge of these stands. Litter depth, groundcover composition and other stand traits were recorded to compare with orchid distributions.

### Results

14 orchid species were found during the study, including a species that is classified as at-risk and another that is threatened. The results show that older stands have significantly higher orchid diversity than younger stands, although it is worth noting that some species found in the current reserve were conspicuously absent from all the *P. radiata* stands surveyed. Logistic regressions will be used to investigate how stand traits such as litter depth, stand age, and groundcover composition affect the likelihood of certain species occurring in a stand.

### Conclusion

Overall, the *P. radiata* stands surveyed in this study provide a habitat for a large proportion of the 20 orchid species that were found in the current reserve during a recent study.<sup>2</sup> The most important stands in terms of the orchid diversity they support are in the older age classes. However, regarding changing the reserve's location, the absence of some orchid species in the *P. radiata* stands is important, indicating that translocation of some species would be necessary in order to conserve the diversity seen in the reserve.

### References

1. Gibbs, M. (1988). Iwitahi: A Native Orchid Reserve in Exotic Pine Forest, New Zealand. *Orchadian* 9(3), 49-51.
2. Steel, G., & Clearwater, M. (2021). Iwitahi Native Orchid Reserve: Species Distributions and Future Directions for Sustaining Orchid Populations. *OCNZ Yearbook 2021 Ed.*

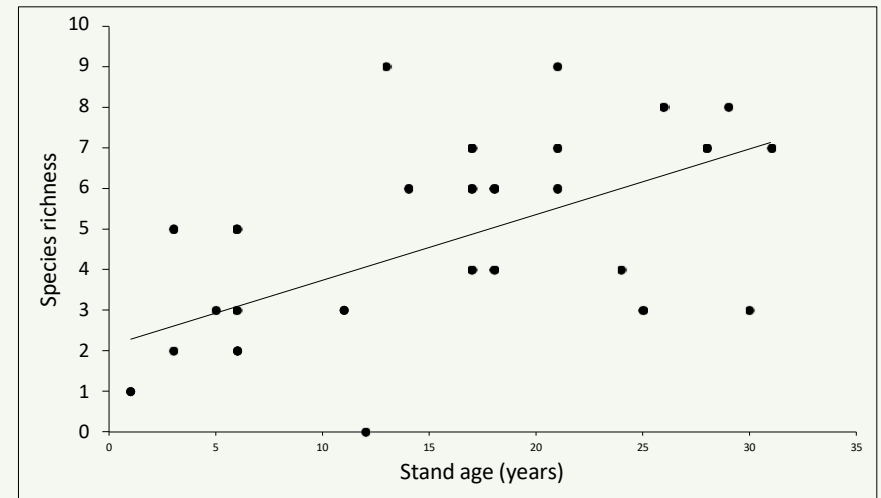


Figure 2. Species richness for stands against stand age



# Simulating a Vehicle Battery Using Variable, Real-World Conditions

Poster by Logan Cowie, Supervised by Marcus Wilson and Jonathan Scott

## Background

Battery technology will play a pivotal role in a decarbonised future. Currently, batteries are the weakest component in high power electronics such as electric vehicles.

This is because modelling of battery performance has been overly simplified, leading to compromised battery efficiency and longevity.

## Constant Phase Element (CPE)

A battery is made up of a CPE, a capacitor and a resistor [1]. The capacitor and resistor are easy to model, but the CPE is more complex. That is why current technology replaces the CPE with a simple "black box" model that only behaves the same as a CPE under specific lab conditions. The resulting models are inaccurate in the varying conditions of the real world.

## Published Research

One of the first CPE models, developed by Morrison in the 1950's [2], was an approximation of the theoretical model. It required a large frequency range, but it was accurate in only a very limited range. Morrison's method prioritised speed over accuracy.

The Waikato University Battery Modelling Group recently developed an accurate theoretical CPE model using MATLAB. This model required significant computing resources and at least 24 hours to run successfully.

## Current Research

In order to improve the processing speed, my research used SPICE (Simulation Program with Integrated Circuit Emphasis) to create a CPE model that improved on Morrison's approximation method but incorporated the accuracy of the MATLAB model. These improvements drastically increased the proportion of the frequency band that produced accurate results. My model only takes 45 seconds to run on a standard computer while keeping the same level of accuracy as the MATLAB model.

## Future Impact

This improved CPE model will lead to improved accuracy of real time battery data. It will enable optimised battery management leading to better output, efficiency and lifespan of batteries. It will also accurately quantify the health of the battery.

## References

- [1] E. Poihipi, J. Scott and C. Dunn, "Distinguishability of Battery Equivalent-Circuit Models Containing CPEs: Updating the Work of Berthier, Diard, & Michel," *Journal of Electroanalytical Chemistry*, vol. 911, 2022.
- [2] R. Morrison, "RC constant-argument driving-point admittances," *IRE Transactions on Circuit Theory*, vol. 6, pp. 310-317, 1959.
- [3] S. Seshadri and J. Scott, "Corrections to Compact Nonlinear Model of an," *IEEE Transactions on Biomedical Circuits and Systems*, 2018.

## Acknowledgments to

University of Waikato Summer Research Program, University of Waikato Battery Modelling Group, and Vance Farrow (Team Member)



THE UNIVERSITY OF  
**WAIKATO**  
*Tē Whare Wānanga o Waikato*







# Floral Origin of Honey by NMR

Nicholas Hagan  
Supervisors:  
Dr. Megan Grainger and  
Dr. Merylyn Manley-Harris  
Te Aka Mātuaatua

## Problem

Melissopalynology, the current method for determining floral origin, is costly and takes great skill and training.<sup>1</sup>

## Incentive

Exploring cheaper alternatives would make identifying fraud in honey products more efficient.

## Solution

Nuclear Magnetic Resonance (NMR) Spectroscopy coupled with Principal Component Analysis (PCA).



## Methods

- Extract honey, separate wax.
- Obtain chemical profile by <sup>1</sup>H NMR.
- Bucket integration of whole spectra.
- Peak area & chemical shift as PCA variables.
- Check groupings against reported botanical origin or flora at collection site.

## Results

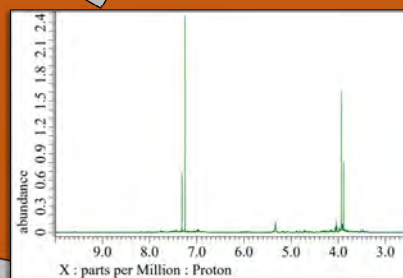
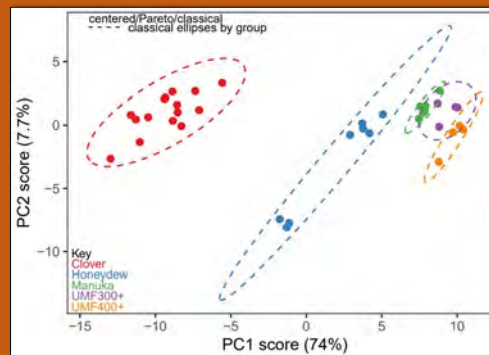
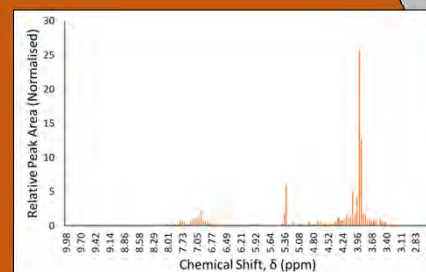


Figure 1. <sup>1</sup>H NMR spectrum of UMF400+ sample (Top Left).  
Figure 2. Bucket integration of the NMR spectrum of UMF400+ (Top Right).  
Figure 3. PCA plot of all samples. Honeydew outgroup contained wax (Bottom Right).



## Discussion

PCA of three commercial honey products of different varieties revealed three distinct groups. Manuka product origin validated by UMF certified samples.

## Future

Processing honey from local hives. DNA sequencing local flora. Compare with PCA results of honey with certified origin.



[1.] Schievano, E., Finotello, C., Uddin, J., Mammi, S., & Piana, L. (2016) Objective Definition of Monofloral and Polyfloral Honeys Based on NMR Metabolomic Profiling. *Journal of Agricultural and Food Chemistry*, 64, 3645-3652.



# IMPORTANCE OF DUNG RETURNS FOR BUILDING SOIL CARBON

Holly Hay, Louis Schipper, Aaron Wall and Seager Ray  
University of Waikato, New Zealand

## INTRODUCTION

- The conversion of natural ecosystems for agricultural use has resulted in the release of carbon from soil.<sup>1</sup>
- This soil carbon deficit presents the opportunity to capture atmospheric CO<sub>2</sub> in soil.<sup>1</sup>
- Dung returns have been suggested as an important contributor to maintaining soil carbon in agricultural systems.<sup>2</sup>
- The inability for cows to graze under fences is hypothesised to result in lower dung inputs than paddocks.

## AIM

Compare soil carbon stocks of paddocks and adjacent fence lines to determine how important dung returns are for soil carbon storage

## METHODS

At each of the 5 paired sites, 6 cores from the paddock and 6 cores from the fence line (Fig 1) were bulked by depth. Samples were air-dried, sieved (>2mm) and ground before analysis using an Elemental Combustion Analyser.

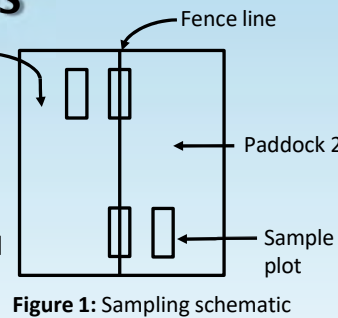


Figure 1: Sampling schematic

## RESULTS

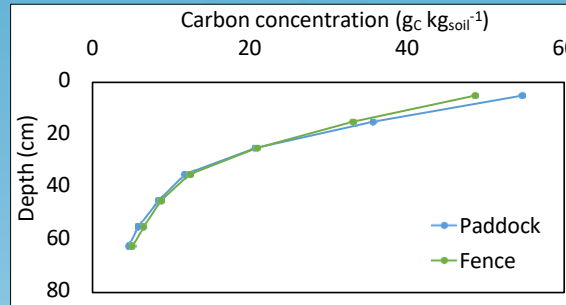


Figure 2: Average soil carbon content with depth

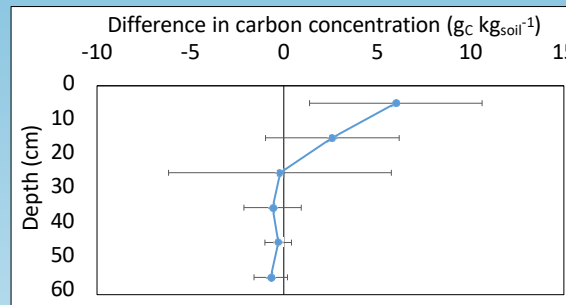


Figure 3: The average difference (95% confidence interval, n = 5) in the concentration of carbon detected in the soil between the paddocks and fence lines.

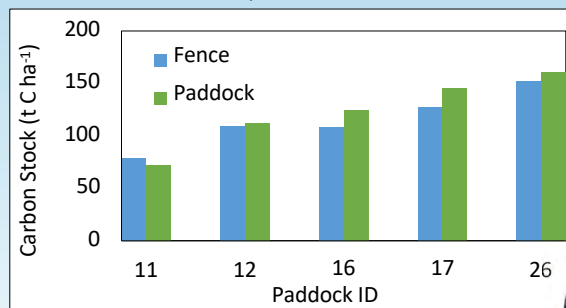


Figure 4: Cumulative carbon stocks of paddocks and fence lines to 60 cm

## DISCUSSION

- Soil carbon decreased with increasing depth (Fig 2) as generally observed.
- There was more carbon in the top 10 cm of soil in paddocks than fences (Fig 3) as hypothesised.
- However, when cumulative carbon stocks to 60 cm (Fig 4) were considered, some of the differences found in the topsoil diminished. This demonstrated that changes in carbon concentration were considerably more variable in the subsoil, making the detection of differences in soil stocks at 60 cm more difficult.<sup>3</sup>

## CONCLUSION

- We found support for our hypothesis that dung inputs increase soil carbon

## FUTURE RESEARCH

- Analysis of additional soil samples is yet to take place.
- Research to quantify the inputs of dung in paddocks and under fence lines is required
- Further research needs to be carried out at other locations in order to validate our findings.

## REFERENCES

1. Ontl, T. A., & Schulte, L. A. (2012). Soil carbon storage. *Nature Education Knowledge*, 3(10).
2. Wall, A., Campbell, D., Mudge, P., Rutledge, S., & Schipper, L. (2019). Carbon budget of an intensively grazed temperate grassland with large quantities of imported supplemental feed. *Agriculture, Ecosystems & Environment*, 281, 1-15.
3. Ellert, B. H., Janzen, H. H., McConkey, B. G., & Lal, R. (2001). Measuring and comparing soil carbon storage. *Assessment methods for soil carbon*, 131-146.



# CHARACTERISING THE DNA POLYMERASE OF PROCHLOROCOCCUS MARINUS



## Introduction:

*Prochlorococcus marinus* is the **most abundant** photosynthetic cyanobacteria. It plays a major role in regulating carbon dioxide. This bacteria has evolved into 2 different strains (high light and low light). One important enzyme is DNA Pol I enzyme which is involved in the replication and repair of DNA.



### HIGH LIGHT (HL, MIT9312)

- High UV fluxes
- High temperatures
- Low nutrient availability

VS

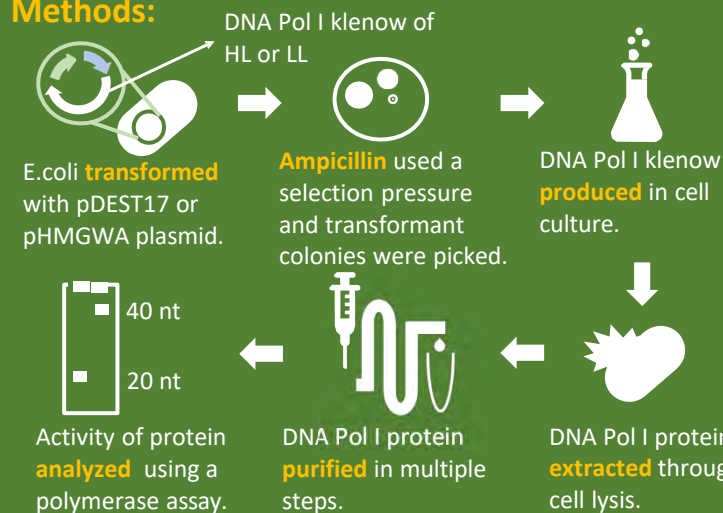
### LOW LIGHT (LL, MIT9211)

- Low UV fluxes
- Low temperatures
- High nutrient availability

**Hypothesis:** The DNA Pol I klenow of the HL variant will have a higher rate of activity than LL because HL is more likely to be damaged and would require more proofreading for errors in DNA.

**Aim:** To express, purify and analyze HL and LL strains for comparison.

## Methods:



## Results:

I produce ~20% of atmospheric oxygen!

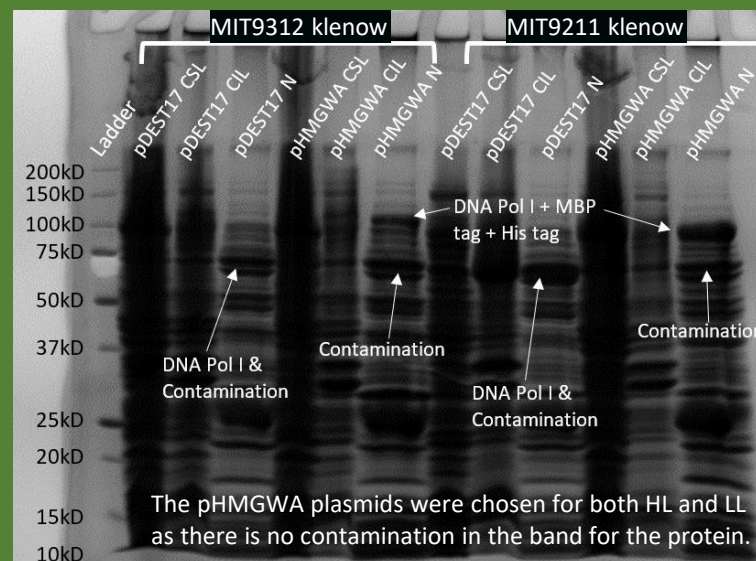


Figure 1. The nickel pull-down result to decide which plasmid to use. CSL = crude soluble lysate, CIL = crude insoluble lysate and N = nickel bead sample.

- The pHMGWA plasmid consists of DNA Pol I (from HL or LL), MBP tag, and His tag.
- The pDEST17 plasmid consists of DNA Pol I (from HL or LL), and His tag.
- Uncertain where the (75.73kDa) DNA Pol I for MIT9312 went after the TEV was added.
- A possible reason for this is that....there was low expression of the protein before purification, and this evaporated overnight when cleavage was occurring.

## Conclusion/Next steps:

The HL and LL pHMGWA plasmids showed better expression. **Up-scaling** the expression for the HL **requires further optimization**. The **polymerase assay works but the purification of LL requires optimization** to decrease contamination and to improve the results on the assay. Once the optimization is complete, it will enable comparison of the polymerase assay of HL and LL.

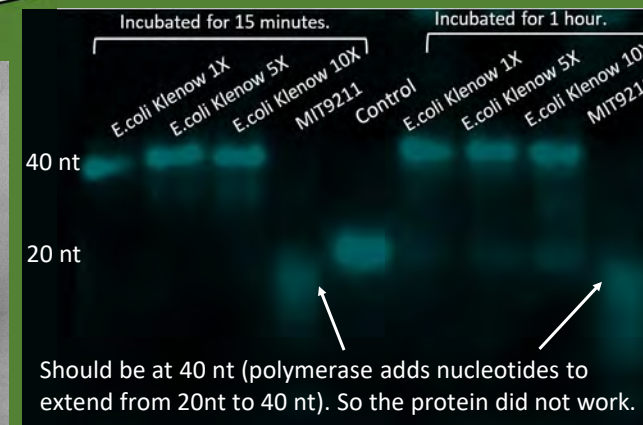


Figure 2. The polymerase assay result for MIT9211 pHMGWA klenow (1X, 5X and 10X are dilution factors).

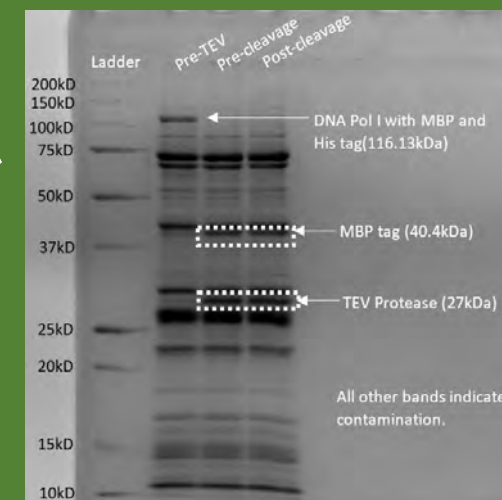


Figure 3. The SDS-PAGE gel for the reverse-His-trap of MIT9312 klenow pHMGWA.

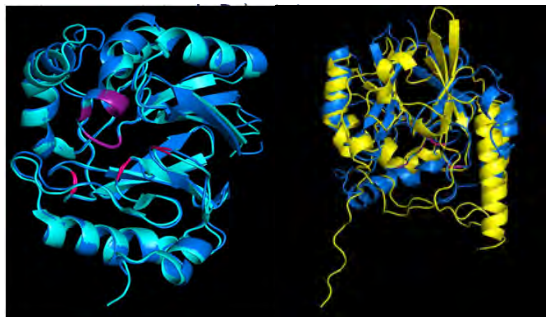


## Antibiotic resistance in *N. gonorrhoeae* is increasing - many strains are now resistant to frontline antibiotics.

Multidrug resistance for it is yet to be detected in New Zealand but with increasing occurrence internationally its arrival is inevitable. My summer Research has ultimately been to express a predicted metallo beta-lactamase (Ngo\_MBL). And Identify its possible causative function towards enhancing antibiotic resistance in *N. gonorrhoeae* (1).

**The 3 possible functions were deduced from published literature, sequence and molecule comparisons:**

1. A Nuclease acting alongside a neighboring DNA ligase
2. A Metallo- $\beta$ -Lactamase to degrade Antibiotics
3. A Glyoxalase II working in conjunction with Glyoxalase I to convert cytotoxic methylglyoxal



**Figure 1:** Ngo\_MBL (Blue) molecule formatted with Alpha fold, compared and aligned with (left) a Glyoxalase II, YcbL (light blue) from *Salmonella enterica* serovar Typhimurium (PDB: 2XF4\_A) (2) and (Right) aligned with L1 metallo- $\beta$ -lactamase (yellow) from *Stenotrophomonas maltophilia* (PDB: 1SML\_A) (3) You can see resemblance with the Glyoxalase II, where the Active sites and Zinc coordinating residual (pink/purple) line up.

- Ngo\_MBL x YcbL = 46.65% sequence identity  
- Ngo\_MBL x L1 metallo- $\beta$ -lactamase = 31% sequence identity

## Methods

Ngo\_MBL was expressed in *Escherichia coli*.

- o pENTR Plasmid encoding the Ngo\_MBL gene was transformed into *E.coli* DH5 $\alpha$  via heats shock. Ngo\_MBL was then transformed further from pENTR to pDEST17 and pHMWGA using a LR/Gateway cloning reaction. pDEST17 and pHMWGA were then transformed in *E.coli* strain BL21 pLysS for expression. SDS page gels were used to ensure successful transformation. Antibiotics were used to select for *E. coli* that have taken up the plasmids.

**Small and Large-scale Purification of pHMWGA were successful showing the protein in the nickel pull down. The MBP tag was unable to be cleaved.**

**Expression assays**

### 1. Nuclease assays

Two carried out: 1<sup>st</sup> with pUC19 plasmid as the nuclease substrate and 2<sup>nd</sup> with Double stranded and Single stranded DNA substrate. Mg, Mn, Zn, EDTA were used as the activation ions.

### 1. $\beta$ -Lactamase Assays

Ampicillin was used as the antibiotic. And absorbance was tracked to see  $\beta$ -Lactamase activity.

### 1. Glyoxalase II Assays (TO BE DONE)

## Results



**Nuclease assay 1 (puc19 plasmid):** Ladder on the right, 1<sup>st</sup> 5 wells = Ngo\_MBL + metal ions/MQ. 2<sup>nd</sup> 5 wells = Storage buffer + metal ion/MQ (same on both gels)

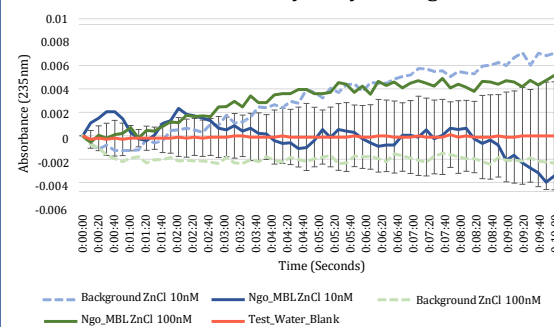
- o No degradation showing Nuclease activity



**Nuclease assay 2 (ds & ss DNA):** the bands that are lower on the gels (including all gel 3) are the ss DNA substrate constructs.

- o Unusual degradation on gel 1, could be due buffer. But other wise no degradation showing Nuclease activity

**Beta Lactamase activity assay with Ngo\_MBL**



- o No Significant decrease in the absorbance of the Ngo\_MBL constructs compared to their controls

## Conclusion and where to go from here:

### -Not a nuclease-

At this point it can concluded that Ngo\_MBL is not a Nuclease as neither nuclease assay's showed degradation of the substrate, apart from with the Single Stranded Rep 1 in the second assay, which was considered insignificant due to not being present in the same place in rep 2 as well as the lack of degradation with any of the other constructs.

### -Possibly still a $\beta$ -Lactamase-

Although the  $\beta$ -Lactamase Activity assay showed no significant decrease in absorbance for the constructs with Ngo\_MBL present in them. Due to the sequence and molecular similarity published for known Beta-lactamases to Ngo\_MBL it would be worth carrying out another purification and attempting to remove the MBP tag (using fresh TEV protease) as this could influence possible  $\beta$ -lactamase activity showing.

### -Glyoxalase II assay-

Also, one of the next step will be to carry out a Glyoxalase assay to help determine final Characterisation.

## References

- (1) Unemo M, Shafer WM. Antimicrobial Resistance in *Neisseria gonorrhoeae* in the 21st Century: Past, Evolution, and Future. *Clin Microbiol Rev.* 2014;27(3):587-613
- (2) Stamp AL, Owen P, El Omari K, et al. Structural and functional characterization of *Salmonella enterica* serovar Typhimurium YcbL: An unusual Type II glyoxalase: YcbL Structure and Function. *Protein Science.* 2010;19(10):1897-1905.
- (3) Ullah JH, Walsh TR, Taylor IA, et al. The crystal structure of the L1 metallo- $\beta$ -lactamase from *Stenotrophomonas maltophilia* at 1.7 Å resolution 1 Edited by K. Nagai. *Journal of Molecular Biology.* 1998;284(1):125-136

**Acknowledgements to Adele Williamson,** Judith Burrows, Mana, University of Waikato Summer Research Program and Maniapoto Māori Trust Board.

# Extremophile DNA-repair Enzyme, NucS-M

Alexandra Perry, Supervised by: Dr Adele Williamson

School of Science, University of Waikato, New Zealand

## BACKGROUND:

NucS-M is an endonuclease involved in DNA-repair pathways [1]. NucS-M has been observed in Antarctic bacteria as well as acidophilic soil bacterium such as *Edaphobacter modestus* [2].

## AIMS:

To understand the function of the N-terminal domain by creating a truncated NucS-M without the domain present and testing its ability to bind DNA.  
To obtain a higher resolution structure of Emod NucS-M and crystallize the mutant.  
Determine the range of DNA damage, pH and temperature these work on by performing a range of assays.

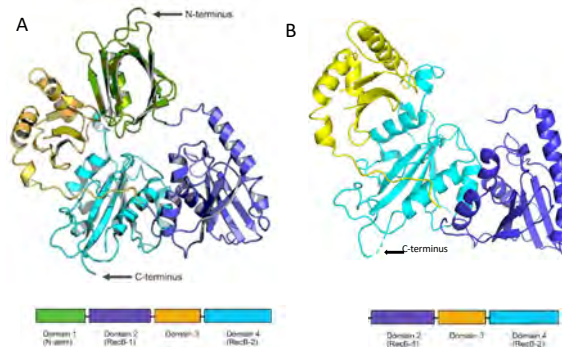
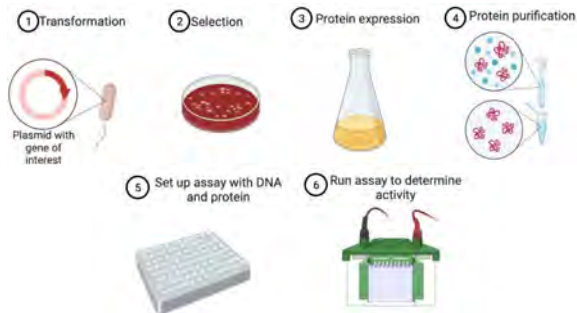


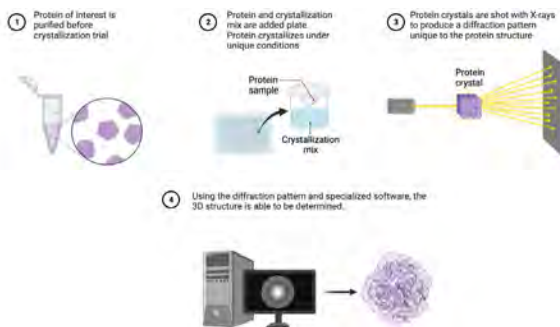
Figure 1: A) Low-resolution structure of Emod NucS-M with sequence. B) Hypothesized structure of the truncated Emod NucS-M with N-terminal removed.

## METHODS:

### Protein Purification and Activity/Binding Assays



### X-ray Crystallography Structure Determination



## RESULTS:

### X-ray Crystallography Structure Determination

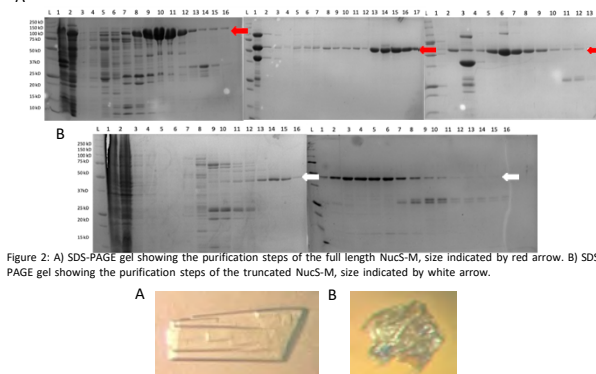


Figure 2: A) SDS-PAGE gel showing the purification steps of the full length NucS-M, size indicated by red arrow. B) SDS-PAGE gel showing the purification steps of the truncated NucS-M, size indicated by white arrow.

Figure 3: A) Crystal of the full length Emod NucS-M B) Crystal of the truncated Emod NucS-M

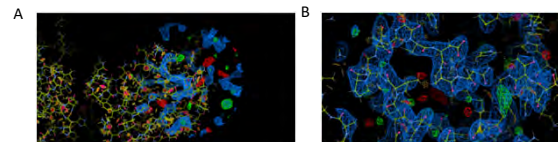


Figure 4: A) N-terminus of Emod NucS-M (Low density) B) Domain 3 of Emod NucS-M (high density)

Table 1: R-Work and R-Free before and after attempting to rebuild the Emod NucS-M structure from the data set. Resolution included on table

	R-Work	R-Free	Resolution
Initial	0.2772	0.3528	2.59 Å
Final	0.2647	0.3587	

Due to the low electron density seen within the N-terminus region of the data (Figure 4,A) it isn't likely that a high resolution structure will be obtained, with any rebuilding the R-Work and R-Free both increased. This is due to the flexible nature of this domain and the position it was in when crystallized. Therefore, further work will be done in order to obtain a better data set and higher resolution structures.

## REFERENCES:

- 1 Takemoto, N., I. Numata, M. Su'etsugu and T. Miyoshi-Akiyama (2018). "Bacterial EndoMS/NucS acts as a clamp-mediated mismatch endonuclease to prevent asymmetric accumulation of replication errors." *Nucleic Acids Res* **46**(12): 6152-6165.
- 2 Koch, I. H., F. Gich, P. F. Dunfield and J. Overmann (2008). "Edaphobacter modestus gen. nov., sp. nov., and Edaphobacter aggregans sp. nov., acidobacteria isolated from alpine and forest soils." *Int J Syst Evol Microbiol* **58**(Pt 5): 1114-1122.Z

## Activity Assays

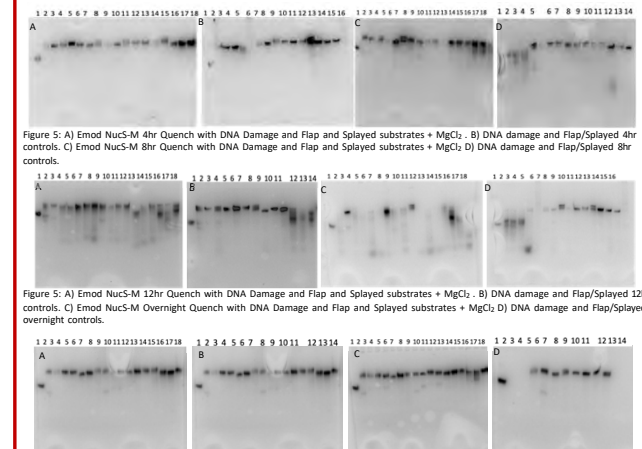


Figure 5: A) Emod NucS-M 4hr Quench with DNA Damage and Flap and Splayed substrates + MgCl<sub>2</sub>. B) DNA damage and Flap/Splayed 4hr controls. C) Emod NucS-M 8hr Quench with DNA Damage and Flap and Splayed substrates + MgCl<sub>2</sub> D) DNA damage and Flap/Splayed 8hr controls.

Figure 5: A) Emod NucS-M 12hr Quench with DNA Damage and Flap and Splayed substrates + MgCl<sub>2</sub>. B) DNA damage and Flap/Splayed 12hr controls. C) Emod NucS-M Overnight Quench with DNA Damage and Flap and Splayed substrates + MgCl<sub>2</sub> D) DNA damage and Flap/Splayed overnight controls.

Figure 5: A) Emod NucS-M-tr 8hr Quench with DNA Damage and Flap and Splayed substrates + MgCl<sub>2</sub>. B) DNA damage and Flap/Splayed 8hr controls. C) Emod NucS-M-tr Overnight Quench with DNA Damage and Flap and Splayed substrates + MgCl<sub>2</sub> D) DNA damage and Flap/Splayed overnight controls.

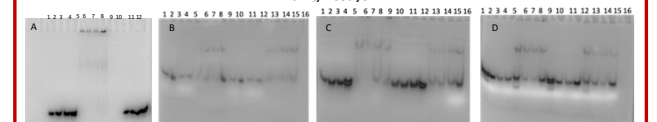


Figure 6: A) 45-minute quench Emod NucS-M (Lanes 1-4) EmodNucS-M-tr (Lanes 5-8) Controls (Lanes 9-12) B) 5hr quench Emod NucS-M (Lanes 1-4 and 9-12) Emod NucS-M-tr (lanes 5-8 and 13-16) C) 3hr quench Emod NucS-M (Lanes 1-4 and 9-12) Emod NucS-M-tr (lanes 5-8 and 13-16) D) 2hr quench Emod NucS-M (Lanes 1-4 and 9-12) Emod NucS-M-tr (lanes 5-8 and 13-16)

With the removal of the N-terminus it is evident that there is more binding present. This is unexpected due to the N-terminus being predicted as the binding domain. Further work is needed to identify the cause of the data.

## OUTCOME:

- Successful purification of both NucS-M full length and NucS-M-tr. Crystals were received for the full length variant, however, these were not of a high resolution.
- Data received from the crystals was not sufficient to rebuild a high resolution structure due to the flexibility of the N-terminus
- The data received from the activity assay was what was expected, however, the data from all trials of the binding assay did not follow the trend of hypothesized data.

## FUTURE STUDIES:

- Further optimize the crystallization conditions of both Emod NucS-M and NucS-M-tr to obtain higher resolution crystals.
- Repeat assays with new purified protein to ensure that the results are accurate and not due to an artifact.
- Work on binding assays to determine why the data was not as expected.



# Soil BON

## A Global Soil Biodiversity Monitoring Initiative



Scan here to learn more!

### What is SoilBON?

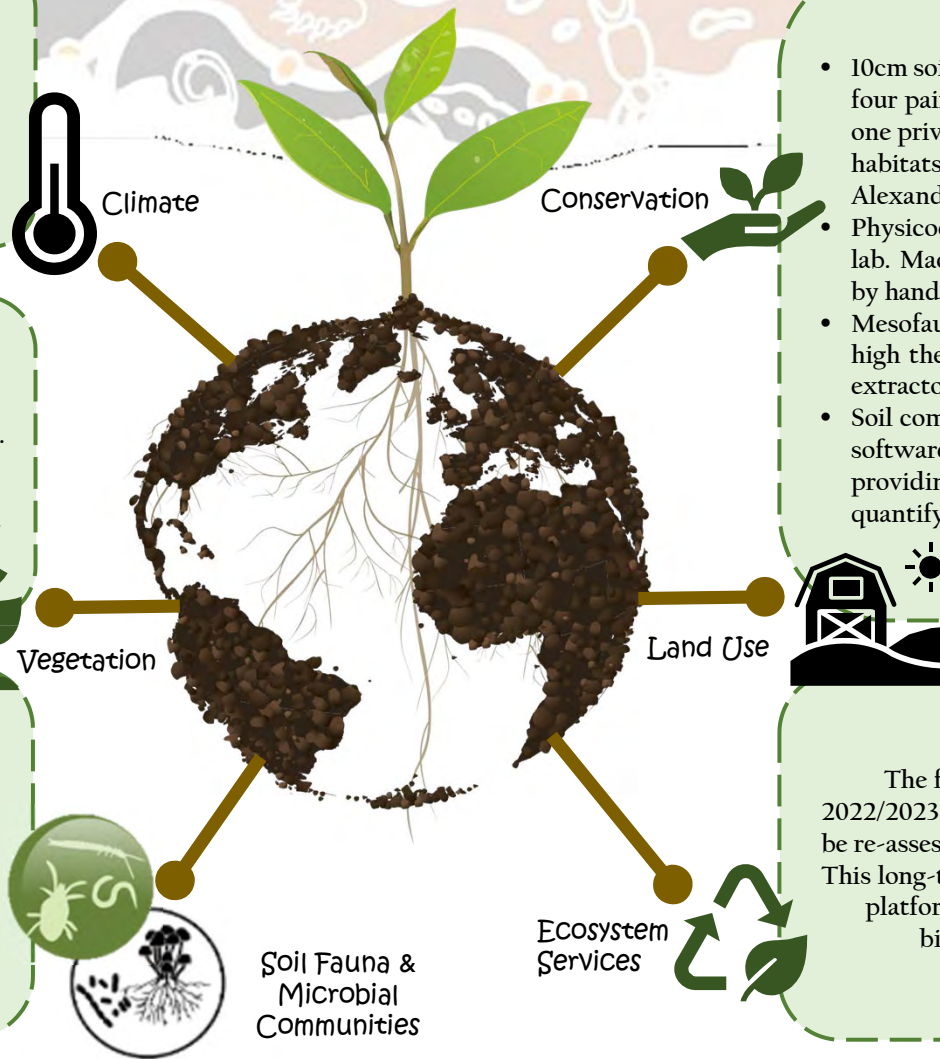
The soil biodiversity observation network is a collaboration of ecologists and research volunteers in over 80 countries aiming to collect comparable long-term data for tracking drivers of soil biodiversity and functions worldwide.

### Background

Soil fauna support vital ecosystem functions through interactions with vegetation and microbial communities. To date, there is a lack of comprehensive data regarding soil communities which cover a variety of fauna, soil functions and environmental conditions.

### Aim

- Contribute data from Aotearoa using standardised methods to help determine the condition of global soil biodiversity in a variety of climates.
- Understand how biological interactions in soil affect ecosystem functions.
- Compare biodiversity of protected vs privately managed soils to monitor the impacts of human activity.



### Methods

- 10cm soil cores and monoliths were collected from four pairs of two adjacent sites (one protected and one privately managed) in grassland and forest habitats within the Canterbury, Mackenzie and Alexandra regions.
- Physicochemical soil properties were assessed in the lab. Macrofauna were extracted from the monoliths by hand.
- Mesofauna and microfauna were extracted using high thermal gradient and Baermann-funnel extractors
- Soil community samples were scanned using AI software at the SoilBON headquarters in Germany, providing accurate taxonomic identification and quantifying abundance.

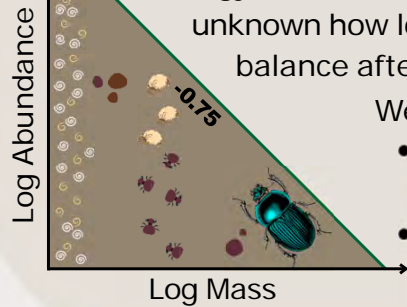
### Conclusion

The first global sampling campaign began in 2022/2023. Over 200 sites covering every continent will be re-assessed every three years for a total of ten years. This long-term data should give researchers a thorough platform to monitor and predict changes in soil biodiversity and ecosystem functions.

# ENERGY EQUIVALENCE IN RESTORED FORESTS

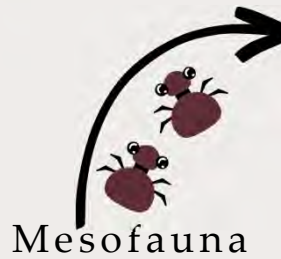
## INTRODUCTION

Most ecological communities have a negative relationship between mass and abundance, due to limited available energy, also known as 'energy equivalence'<sup>1,2</sup>. However, it is unknown how long it takes communities to regain energy balance after disturbance and restoration occurs.



We hypothesise that:

- Population abundance decreases with increasing organism body mass (left).
- This negative relationship holds for communities competing over the same resources<sup>2,4</sup>.



## OBJECTIVES

Test for energy equivalence in restored belowground forest communities throughout New Zealand.

- Compile data on soil fauna body mass and abundance from 76 restoration sites across New Zealand.
- Test for negative mass-abundance relationships (evidence for energy equivalence) by invertebrate size class (i.e., macrofauna, mesofauna, nematodes) and then by trophic group (Fig 1).

## CONCLUSION

Most mass-abundance relationships were positive, providing little evidence for energy equivalence in soil fauna communities (Fig 1). Reasons why the expected relationship was not seen are:

- Soil communities are complex and feed on various food sources producing relationships different to those predicted<sup>5</sup>.
- Disturbances may reduce competition and relax energetic constraints (e.g., within young and disturbed forests)<sup>3</sup>.

## RESULTS

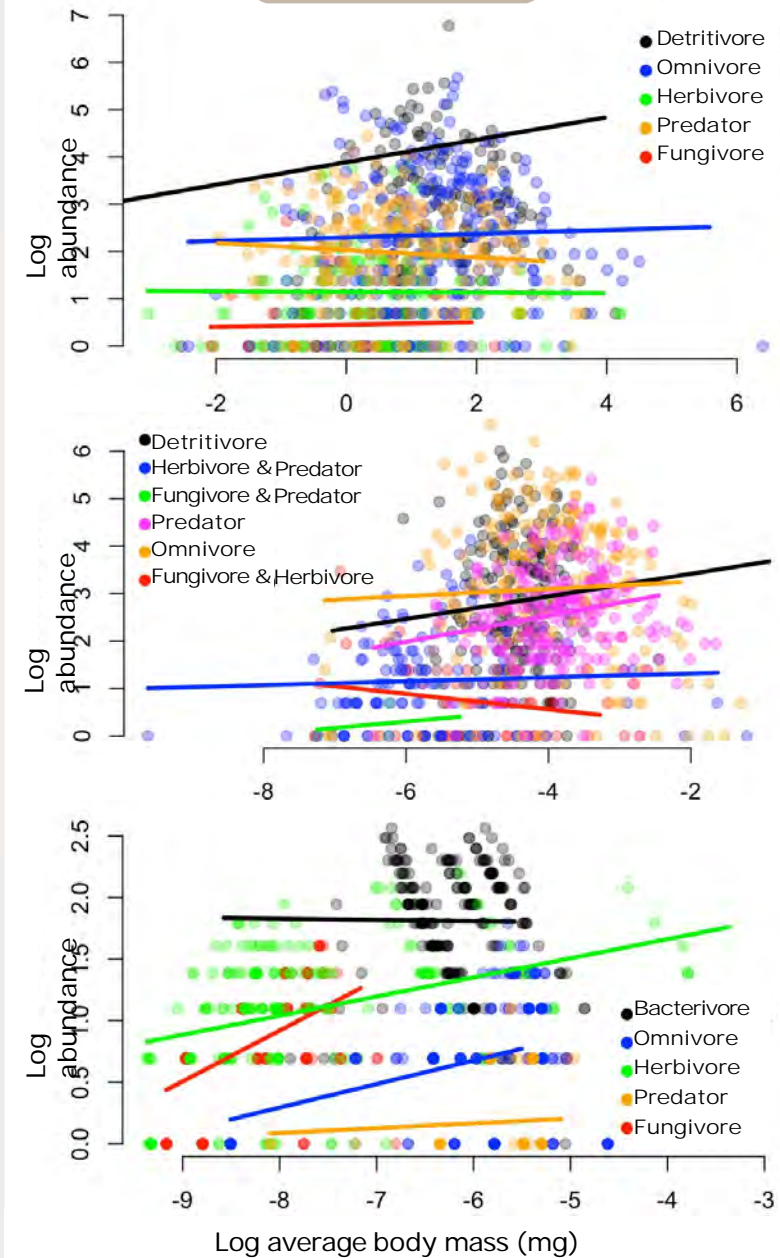


Figure 1 - Mass vs abundance plots by invertebrate size class (macrofauna, mesofauna, nematodes) and then by trophic group (as per legend).

## REFERENCES



Poppy (Joaquina) Romera, Andrew Barnes and Kiri Joy Wallace  
Te Aka Mātuaatua School of Science, University of Waikato, New Zealand





Waikato University



Monash University



James Cook University

# Why are my shells dates problematic?

Research undertaken by Josh Smith.  
Supervised by Associate Prof. Fiona Petchey.  
Special thanks to Prof. Ian McNiven, Prof. Bruno David, Prof. Sean Ulm, Kathleen Dabell, Helen Turner, Kirsty Vincent, and Toni Cornes.

## Background/Introduction:

Certain shells have returned anomalous radiocarbon dates in the upper layers of archaeological excavation sites at Cation Bay, along the southern coastline of Papua New Guinea. Samples from the uppermost units have returned dates more than 500 years older than expected.

This study aims to investigate if recrystallisation is the cause of anomalous dates as well as the effects various temperatures have on the modern shells crystal structure. Of specific concern is the possibility of cryptic recrystallisation, (diagenetic, sometimes meteoric, syntaxial crystal overgrowths or cement infill of the same mineral crystal structure, in this case aragonite), (Petchey et al., 2022).

This will be achieved by comparing the archaeological XRD, XRF, and SEM data against the modern shells.

## Methods:

The shell taxa investigated were: *Lambis sp.*, *Anadara antiquata*, *Anadara granosa*, *Conomurex luhuanus*, *Gafrarium sp.*, and *Strombus luhuanus*. Modern reference shell taxa *Anomiidae* is calcitic with a nacreous microstructure, (Jacob et al., 2008), all others investigated were aragonitic with crossed-lamellar structure.

Shells were subsampled for XRD, XRF and high definition/resolution SEM imagery analysis before and after a heating experiment at 200, 400, and 600 °C.

## Preliminary Results:

No evidence of diagenetic recrystallisation was found in archaeological samples. The following microstructure changes were noted in the high resolution SEM

imagery of the heated modern control samples.

The nacreous structure of *Anomiidae* showed cracks at temperatures greater than 400 °C, but no secondary minerals, (figure 1).

At temperatures greater than 400 °C pores formed and the crystal laths appear to be melted. In *Anadara antiquata* shells, needle crystals formed, (figures 2 & 3).

Secondary mineralization was not present in any archaeological samples, (figure 4).



Figure 1. *Anomiidae* 600 °C at 4k magnification. 20 µm

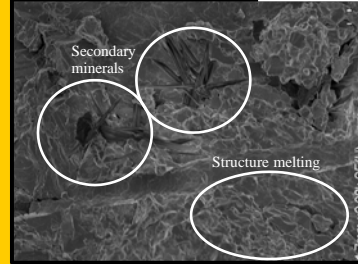


Figure 2. *Anadara antiquata* 600 °C 2k magnification.

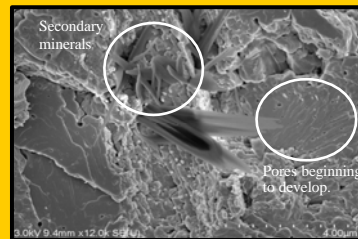


Figure 3. *Anadara antiquata* 400 °C 12k magnification.

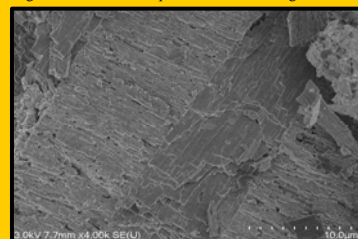


Figure 4. Archaeological *Tegillarca granosa* 4k magnification.

## Preliminary Results Continued:

The following XRF data, (figures 5 & 6), showed that archaeological shells had more Ti (12-16%) and less Ca (30-45%) than the modern reference shells, Ti (3-4%) & Ca (60-75%). Higher temperatures resulted in a lower light element concentration. Recrystallisation to calcite at 400 °C was affirmed by XRD. No changes were identified below 200 °C. Figure 7 is an overlapped XRD spectra.

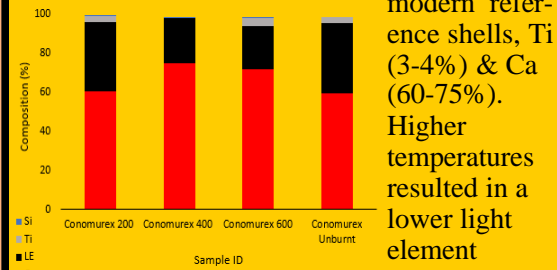


Figure 5. Average compositions of modern reference *Conomurex luhuanus* shells.



Figure 6. Average compositions of archaeological shells.

## Preliminary Conclusions:

No cryptic recrystallisation was identified in any of the archaeological samples. Similarly, the archaeological shells show no evidence of heat damage.

XRF data shows archaeological samples have less Ca and more light elements and Ti. Further research is required to determine why. More investigation is required to determine the cause of the anomalous dates.

Dissolution experiments are in progress that may give further insights into shell decay processes.

## References:

Jacob, D. E., Soldati, A. L., Wirth, R., Huth, J., Wehrmeister, U., Hofmeister, W. (2008). *Geochimica et Cosmochimica Acta*, 72, 5401-5415.  
Mindat. (2023, January 23). Aragonite. <https://www.mindat.org/min-307.html>.  
Mindat. (2023, January 23). Calcite. <https://www.mindat.org/min-859.html>.  
Petchey, F., Piper, P. J., Dabell, K., Brock, F., Turner, H., Dzung, L. T. M. (2022). *Radiocarbon*, 64(5), 1093-1107. DOI: 10.1017/RDC.2022.63.

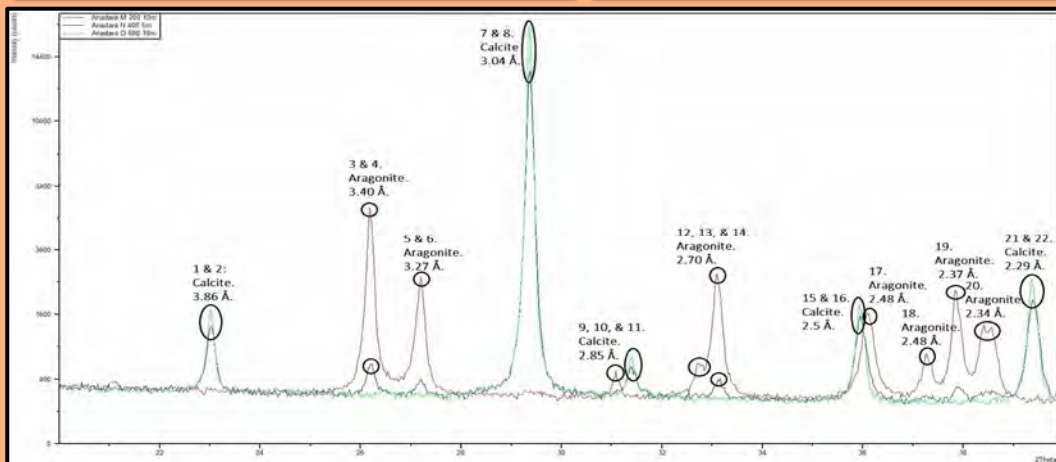


Figure 7. Modern shells *Anadara antiquata*. Peaks compared to Mindat (2023).

# How do physiological traits enable success of invasive blowflies?

Orla White and Dr Ang McGaughran

*Te Akamātuatua School of Science, University of Waikato, New Zealand*

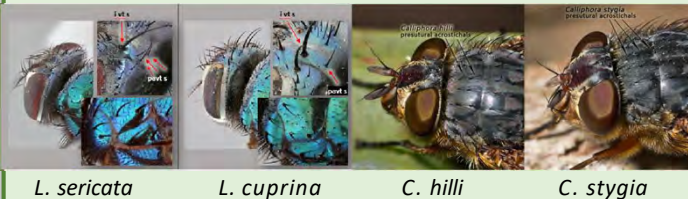
## INTRODUCTION

Blowflies are extremely successful invaders, and their abundance and short life cycles make them ideal for invasive studies translational to other animals. Global warming is an issue which affects all, and thus it is important to get an idea of what might happen to pests such as blowflies as the Earth warms [1]. Two related factors which can easily be assessed in the laboratory are heat tolerance [3] and desiccation resistance, thus:

**Aim:** To investigate whether heat tolerance and desiccation resistance differ between species of blowfly.

Morphologically, there are minute differences between *L. sericata* and *cuprina* and *C. hilli* and *stygia* (see images below). The two *Lucilia* species have been highly successful invaders, while *C. hilli/stygia* are not so capable[3].

**Hypothesis:** *L. cuprina/sericata* will be better able to withstand heat and desiccation compared to *C. hilli/stygia*.



## METHOD

Different methods were tested for collecting blowflies including malaise, emergence, pan and composite traps [4], however the best method was using rotten meat as bait and manually catching flies in a net.

### Heat Tolerance

Flies were placed in 15mL tubes and into an incubator set at 43°C (initial tests found 44°C to be the lethal temp for these flies) and heat knockdown time was measured. *L. cuprina/sericata* were caught from rural and urban sites.

**Knockdown time:** Beginning of temperature exposure until the fly drops to the bottom of the tube and can't rise.

### Desiccation Resistance

Flies were given water, sugar and a small amount of meat for 3 days, then water was removed from the treatment cages. The number of dead flies in each cage was recorded every ~24 hrs.



Bait for netting (left), pan trap (centre), and emergence, composite and malaise traps (right L-R)

## RESULTS

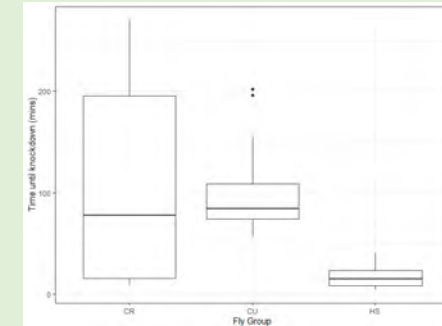


Figure 1. Time until knockdown of flies maintained at 45°C with /*sericata* (n=30), CU:urban *L. cuprina/sericata* (n=30), CR: rural *L. cuprina* and HS: *C. hilli/stygia* (n=30)

- No significant difference between average knockdown time for rural ( $\mu=100.79$ ) and urban ( $\mu=95.92$ ) *L. cuprina/sericata* ( $p=0.576$ )
- There was a significant difference in average knockdown time for *C. hilli/stygia* ( $\mu=16.53$ ) vs rural ( $p=1.24e-6$ ) and urban ( $p=1.25e-16$ ) *L. cuprina/sericata*
- Results for desiccation resistance testing are unfinished but *C. stygia/hilli* have died at a faster rate than *L. cuprina/sericata* (Fig. 2).

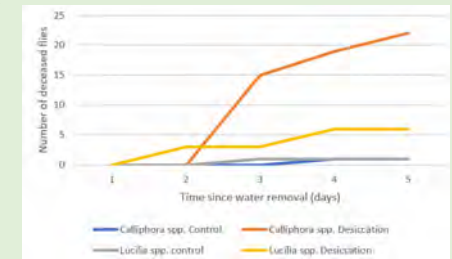


Figure 2. number of total deceased flies each day after water removal. All groups n=30

## ACKNOWLEDGEMENTS

Immense thanks to Ang McGaughran and Nathan Butterworth for everything they've taught me, and for giving me this amazing opportunity. Thanks also to Lilly Croft, Stacey Meyer, Bruce Patty, the rest of the McGaughran lab and lastly, to the University of Waikato Summer Research Programme.

## DISCUSSION

**Conclusion:** *Lucilia spp.* are more resistant to heat and desiccation than *Calliphora spp.*

- The high variation in rural *Lucilia spp.* heat tolerance may be due to the increased number of stressors present in rural environments, encouraging greater variation in overall fitness
- *Lucilia spp.* and *Calliphora spp.* may differ in performance of both factors due to difference in body size. *Calliphora spp.* tend to be much larger which may effect rates of heat/water loss.
- Urban *Lucilia spp.* likely rely more on behavioural heat avoidance so may not have evolved the physiological capabilities to last as long as some of the rural *Lucilia spp.*

## REFERENCES

- [1] Frelich, L. E., & Reich, P. B. (2009). Wilderness conservation in an era of global warming and invasive species: a case study from Minnesota's Boundary Waters Canoe Area Wilderness. *Natural Areas Journal*, 29(4), 385-393.
- [2] Esperk, T., Kjaersgaard, A., Walters, R. J., Berger, D., & Blanckenhorn, W. U. (2016). Plastic and evolutionary responses to heat stress in a temperate dung fly: negative correlation between basal and induced heat tolerance?. *Journal of Evolutionary Biology*, 29(5), 900-915.
- [3] Heath, A. C. G., & Bishop, D. M. (2006). Flystrike in New Zealand: An overview based on a 16-year study, following the introduction and dispersal of the Australian sheep blowfly, *Lucilia cuprina* Wiedemann (Diptera: Calliphoridae). *Veterinary parasitology*, 137(3-4), 333-344.
- [4] Russo, L., Stehouwer, R., Heberling, J. M., & Shea, K. (2011). The composite insect trap: an innovative combination trap for biologically diverse sampling. *Plos one*, 6(6), e21079.





# Waikato Management School

# DELTA OUTBREAK & SMES

BY JESSICA KONG, DR ABHISEK MUKJERHEE, & JONATHAN SCOTT

: A FOLLOW-UP STUDY

## 1 BACKGROUND

Covid-19 lockdowns have placed a strain upon businesses of all sizes this study aims to divulge how local small and medium enterprises have fared during this unprecedented time. In 2020, McGlade, Scott, and Mukherjee studied the experiences of local SMES. We interviewed the same businesses on the topic of the Delta outbreak. How did the second lockdown affect SMES? Have they adapted? If so, what methods did they use?

## 2 METHOD

A questionnaire was used to conduct interviews with the owner-manager of SMES in The Waikato and Tauranga region. Unfortunately, only 10 participated out of 17 from the previous study. The questionnaire covered government response, employment, finances and strategic planning which are all important aspects of running a business. The qualitative data was then input into NVivo which identifies themes and patterns.

## 3 ANALYSE

We focused on using a dynamic capabilities lens on how businesses have adapted through lockdown and if they have pivoted their business models. Here are some important finds:

- 50% of respondents mentioned that government regulations were difficult to navigate around as opposed to 76% in the previous study.
- 80% of respondents reported growth post-lockdown compared with 71% in the previous study.
- 70% increased their business's online presence.

## 4 CONCLUSION

The interviews gave insight into how owner-managers from local SMEs have navigated through their 2nd course of lockdown. Pre-planning for the Delta outbreak like cutting costs and switching to a lean management approach has led to financial growth. The pace of news from the government necessitates SMEs to adapt quickly. Hence, the deployment of dynamic capabilities helps businesses to survive and thrive.

## ACKNOWLEDGEMENTS

Thank you to Dr Abhishek Mukjerhee for supervising this study and providing me with useful tips on writing. I'd like to thank Jonathan Scott for meticulously editing my report, Paul McGlade who has helped connect me to the participants from the previous study, and all the participants for their valuable time.





# How alternative financing can be used to increase access to capital for Māori small and medium enterprises in New Zealand



THE UNIVERSITY OF  
**WAIKATO**  
*Tē Whare Wānanga o Waikato*

## Introduction

The purpose of the research is to investigate how alternative financing can be used to increase access to capital for Māori small and medium enterprises (SME's) in New Zealand.

Our goal is to identify any barriers to entry or challenges faced by Māori entrepreneurs seeking finance and better understand the experience of interaction between Māori SME's & traditional streams of financing.

By conducting this research we hope to collect valuable information about the Māori perspective of financial markets and hope to build a coherent map of the Māori funding ecosystem.

This study is the first step in what should be a long-term action based project to improve financing options for Māori entrepreneurs using new financial technology.

*What financing challenges are Māori enterprises facing and what is the most appropriate solution?*

## Methodology

The methodology for our research consisted of recording a combination of primary and secondary data in the area regarding access to capital and financing options for Māori.

The primary data we collected consisted of qualitative interviews from Māori business owners, previous iwi board affiliates and Māori land based entity owners or shareholders. Interviews mainly involved a kōrero (conversation) about the interactions with traditional financial markets, details of the governance of Māori trusts and personal challenges faced when financing a new venture.

The secondary data we collected were public interviews with other Māori business owners and high quality research papers recorded in this area.

We used this data to create a few headline issues and solutions that were a fair consensus of the issues current in the Māori funding ecosystem.

**Acknowledgements:** I would like to thank my supervisors: Dr Abhishek Mukherjee, Paresha Sinha and Paul Griffiths for their persistent hard work and guidance in the project. I would also like to especially thank all of our research participants who gave up their time to speak with us and teach everyone about the Māori experience in business.



## Issues

- There are difficulties in lending on Māori land as **collateral** due to ownership structure
- There is a Māori way of doing business but not a Māori **commercial model** as of yet
- There is a limited understanding of **Māori values** within the financial sector and this is affecting investor confidence



## Solution

- Provide **access** to and improve **awareness** of equity financing options.
- Create an **intermediary** to provide financial advisory, commercial loans and banking services.
- Promote greater **representation** of Māori across governance & **leadership** of organizations



## Action

- Stimulating discussion in Māori forum about equity financing options
- Creating an independent trust which grants loans on the conditions that suit the Māori business model
- Continue promoting representation of Māori in leadership positions to create an internal understanding of Māori business values

## Conclusion

This research is only the beginning of a project into investigating how financial technology can be leveraged to provide access to capital for Māori entrepreneurs.

Understanding and collating the issues is critical to spread awareness and create action in this area, therefore, it is especially important that we have these conversations with Māori business leaders and innovators to create a financing process with fewer challenges.

We hope in the future of this research Māori entrepreneurs will be able to secure funding streams on terms that align with their values and generate equitable outcomes for a growing Māori economy.



# Congratulations to all our Summer Research Students