History of Land Use and Development in Tauranga City

THE UNIVERSITY OF WAIKATO
Te Whare Wānanga o Waikato

Tauranga City

INTRODUCTION

Tauranga is one of the fastest-growing cities in New Zealand. Rapid expansion has reshaped its coastal environment, transformed forests, wetlands, and dunes into an urban coastal city.
This pattern influences the exposure to flooding, erosion and sea-level rise at present.

PURPOSE

The project aims to support decision-makers and communities by examining the interaction of land modification with natural processes and understanding the possible impacts that may occur in future.

DATA: Historical maps were sourced from the Tauranga City Council Library Archives and supplemented with published literatures.

METHODS: Historical maps were interpreted and summarized into timeline in ArcGIS StoryMap, then linked to present-day flood and erosion exposure.

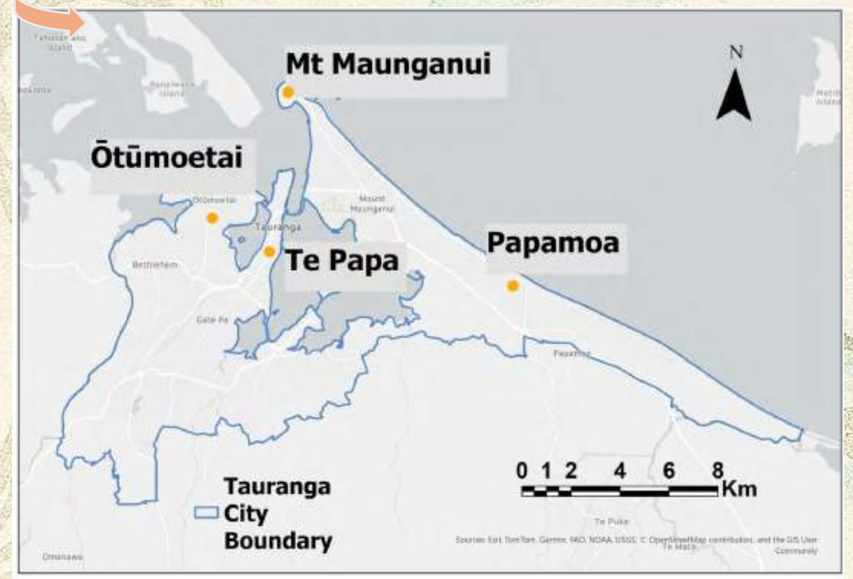


Figure 1: Location map showing major land use change areas within the Tauranga city.

TIMELINE OF LAND USE CHANGE

PRE-HUMAN
Landscape was shaped by coastal, estuarine, river, and volcanic processes.

1300s — MĀORI ARRIVAL (1300s)
- Māori settlement started around 1300 AD and started cultivation.
- Kaharoa ash act as the time marker layer in coastal gardens.

1300–1900s — LAND CONVERSION (1300–1900s)
- Forest cleared, wetlands drainage and converting into farm land.
- Subdivision and infrastructure development.

1900–1970s — INDUSTRIAL GROWTH (1900–1970s)
- Establishment of Omanawa and McLaren hydro projects.
- Formation of Whareroa aerodrome.

1950–1970s — PORT EXPANSION (1950–1970s)
- Harbour bridge and Kaimai tunnel helped in deep-water port growth.
- Reclamation, dredging and new wharves reshaped the harbour edge.

1950–present — POST-WAR SUBURBS (1950–present)
- Rapid housing growth replaced farms with new suburbs and infrastructures.
- Hard surfaces and stormwater pipes increased runoff, local flooding and water-quality pressures.

The timeline highlights the major events in each era that has shaped the landscape from earlier environments to the city we know today.

AFFECTED AREAS

- Low-lying **coastal dunes and beachfronts (Mt Maunganui-Papamoa)** are most exposed to erosion and storm-tide flooding.
- The **harbour edge and CBD (Te Papa, port area)** are vulnerable where the land has been modified, increasing flooding and damage risk.
- **Harbour peninsulas and bays (Ōtūmoetai and nearby low bays)** face inundation, shoreline retreat and soft ground that increases the shaking impact.
- **Drainage low points and estuary margins** can flood quickly during heavy rain.

1943 vs 2025 Tauranga CBD

FUTURE ACTIONS

- Prioritise dune restoration at Mt Maunganui–Papamoa where shoreline retreat is highest.
- Avoid intensification in reclaimed harbour-edge zones with highest flood exposure.

ACKNOWLEDGEMENTS

University of Waikato Summer Research Scholarship Programme
Tauranga City Council: Sarah Bassett, Anna Rengstedt, Arran Murch, Sam Abbiss, Ed Clayton and Olivia Cotter

Prepared by: Anjana Paudel
Supervisor: Professor Silvia Serrao Neumann

Te Ringa Hou

A Māori-Inspired EMG-Controlled Prosthetic Hand

Lia Tupaea, Luke August, Dr Mahonri Owen

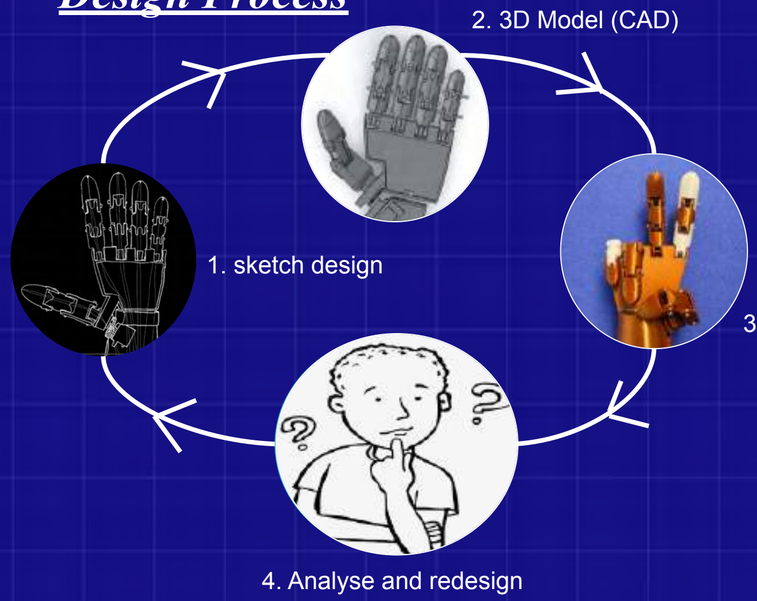
Background

Up to 40% of upper-limb prosthetic users reject their devices due to discomfort, high cost, limited functionality, and lack of cultural relevance. Many commercial prosthetics are designed using a one-size-fits-all approach that may not meet the needs of Māori users. For Māori, cultural identity and connection to natural materials are important for wellbeing and acceptance.

Aim

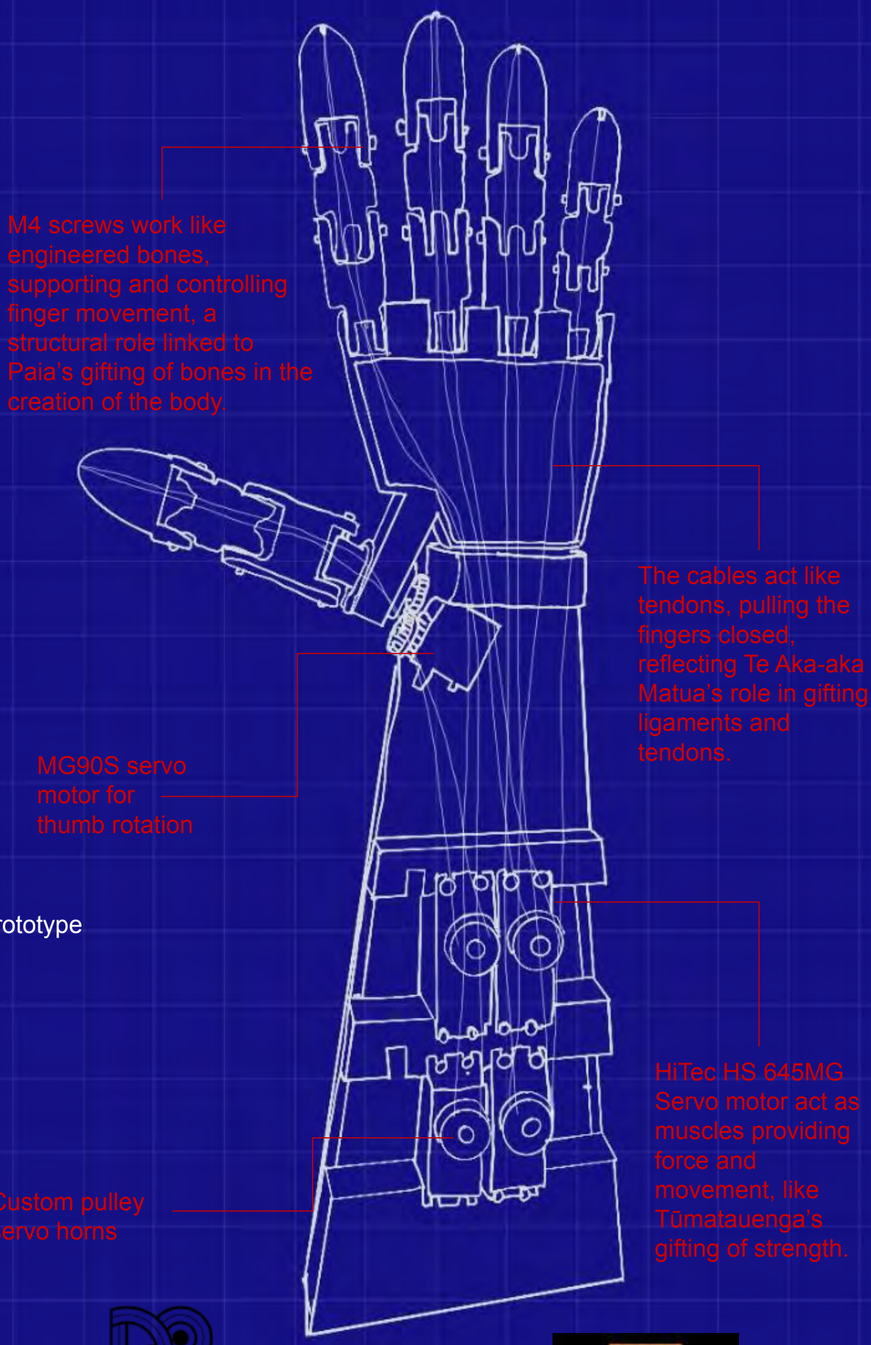
To design a low-cost, Māori-Inspired, EMG-controlled prosthetic hand using harakeke and Māori design principles.

Design Process



Harakeke Filament Production

Harakeke fibres are extracted, treated, and blended with biodegradable polymer to produce 3D-printable filament. The material is tested for strength, flexibility, and print performance.



Te Kura Rau Mahara

THE UNIVERSITY OF WAIKATO

Control System

An EMG armband detects muscle activity in the forearm and converts it into electrical signals. These signals are processed by an Arduino microcontroller and translated into servo motor commands. Different muscle patterns are mapped to hand movements, enabling intuitive and responsive control

Results & Discussion

The prosthetic hand successfully demonstrated basic grip patterns, including open hand, fist, pinch grip, and object holding. Testing confirmed reliable finger articulation and coordinated movement using the EMG-based control system. The low-cost, 3D-printed design supported accessibility and Maori relevance.

However, limitations were observed in grip strength, response time, and signal stability, particularly during extended use. Further optimisation of mechanical components and signal processing is required to improve durability and performance.

Future Development

Future work will focus on producing harakeke-based filament for full hand fabrication and testing. Improvements to grip strength, EMG stability, and system durability will also be prioritised. User trials will assess comfort, usability, and Māori acceptance.

Whanake Ake; Te Pou Whiwhia, Te Pou Rawea

Nā James Te Wharehuia Milroy, i raro i a Prof. Tom Roa

Introduction

Kī mai nei koe Maniapoto kai a koe tonu te pito o te aroha! Ka mahora ki te riu ki Waikato, ki te aroaro o Maniapoto! I tangi ai te pū repo! Ki uta tārei ai, ki tai rewa ai! Te rourou iti ā-haere, maringi kai whenua, maringi kai moana. Mai i te awa whakarite ki te kawau mārō o Maniapoto, Te Nehenehenui ki Waiharakeke. Te whakairinga o te pōhatu ki runga o Uekaha, i ngararu ai te moa, te kiwi i hōī i a Maniatakamaiwaho. E mau nei a maruwehi i te ringa whāwhā a Te Kanawa. Ko Maniapoto te iwi, i taka mai i te roro o te rangi. Tau ki te tukua!

In 1981 the Ngāti Maniapoto Marae PACT Trust (Personal Annual Contribution Target) was founded by the likes of Koro Wētere & Danny Te Kanawa in the hopes of uniting the marae of Ngāti Maniapoto. In 2006 & 2016 respectively the books 'Ngā Hikoinga o te Ngāti Maniapoto Marae PACT Trust' & 'Whanake Ake' were published signifying the trusts success. Now this project sets sail to further intertwine the relationships of member marae with the trust to fully understand the historical essence of these tribal querencia.

Links between Western World Practices & Tikanga Māori

Western World Practices teach us to be steadfast to the line of work, and to be very professional in all aspects of one's pursuit of knowledge. Knowledge may come at a cost or be stored in the archives of a library, however Māori can not solely complete the former activities, and be contempt with the fruits of their laborious work. In this line of research such practices are useful for the intern and provide a firm base for their research, yet, through certain tikanga, this product is given a lush zeal in which reaffirms the pride of the work.

Interviews of pakeke (kaumatua, elders) were partook in which upheld both the tikanga of 'Kōrero tuku iho' where stories are passed down generations, and completed formal interviews in the line of work. The concept of learning in a building away from the lands in which you are learning of may at times be frowned upon in the Māori world, therefore, through travelling to these significant landmarks of tribal history, places were pointed out by the finger, not by a marker on a map. The practice of daily karakia saw the spiritual guidance and protection of spirits, whilst mana was given back to the land in giving light to the names of these historical places. This proves that side by side, these two cultures can thrive in research.

Conclusion

For someone from 'rāwaho' (outside the tribal boundary of Ngāti Manipoto) such a project gave a deep understanding to the mana of this iwi, and to the stories that configure the 'Maniapototanga' of this tribe. The stories learned and gathered is that which should live on forever, as such was the famous saying shouted from the pits of Ōrākau, this tribe and its stories will fight on forever and ever. For these are an ebodiment of one's ancestors. There is no treasure greater than such of representing them with pride.

Jones, P.T.H., & Biggs, B. (1995). Ngā Iwi o Tainui. Auckland University Press
Kelly, Leslie G. (1949). *Tainui*. Capper Press
Phillips, F.L. (1989). *Ngā Tohu a Tainui. Landmarks of Tainui*. Tohu Publishers
Ngāti Maniapoto Marae PACT Trust (2006). Ngā Hīkoinga o te Ngāti Maniapoto Marae PACT Trust.
Ngāti Maniapoto Marae PACT Trust (2016). Whanake Ake

Methodologies

Two different marae belonging to the Ngāti Maniapoto Marae PACT Trust, Pōhatuiri & Tokikapu were selected to be researched in order to further strengthen the ties between the member marae and the PACT Trust. This research was conducted via immersing oneself into the esoteric lore of the Ngāti Maniapoto tribe, through whakapapa (genealogical tables) giving mana to the land, and reading through the historical happenings of ancestors in relation to the marae, and to the land in which the marae sit upon. Sources included the interviewing of local learned descendants of the marae, and books/manuscripts written by the likes of the late Pei Te Hurinui Jones & others. The usage of Māori Land Court minutes, Ngā Tāonga, Papers Past, physical books, and the Māori art of 'Kōrero Tuku Iho' were all thoroughly procured.

Discussion

This project is set out to uphold the mana of marae and the PACT trust in a way in which further affiliates the two parties. Although for the tribe of Ngāti Maniapoto, this research was undertaken by a descendant of Ngāi Tūhoe. Tūhoe who answered the call of Rewi Maniapoto in 1864 to conjoin forces to fight for the land of Ngāti Maniapoto at Ōrākau, through there historical links of the ancestor Tūhoe living in Maniapoto lands in his later stage of life with his wife Hine Te Ata. This relation between the tribes gave an unexpressed understanding of respect for the project.

The research initially started by meeting with the PACT Trust to go over desired outcomes of the project, then the foundational reading of books; 'Ngā Iwi o Tainui', 'Tainui', 'Historical Places of the Tainui People', the two books previously stated published by the PACT Trust, and the countless records of Pei Te Hurinui Jones, and the Māori Land Court minutes.

Through each source, knowledge around the lay of the land, the history of who and what lived there, the formation of significant land marks were obtained, alongside the stories of ancestors of the two marae, and overall tribe of Ngāti Maniapoto, thus finally connecting the two marae, who are very connected with each other, whilst also reaching out to further parts of the North Island. The research was capped off by interviewing different descendants of the two marae, which provided a primary base of knowledge for lore regarding these traditional homelands.

.

THE UNIVERSITY OF WAIKATO
Te Whare Wānanga o Waikato
NEW ZEALAND

Justice without Judges? Exploring the Cultural Legitimacy of Te Pae Oranga

Rebecca Mobberley, Dr Lisa Tompson, & Dr Pounamu Jade Aikman

Background

- Te Pae Oranga is a restorative justice initiative in Aotearoa, serving as an alternative to prosecution.
- Its Māori name means to "talk, listen and become well" which reflects its use of Māori tikanga as the key framework for healing and restoration[1].
- It promotes inter-cultural dialogue between the Crown and Whānau for both Rangatahi and adults, allowing for victim and perpetrator's accounts to be heard[2]. This helps panel co-ordinators to understand what is needed for restoration and for the justice process to be complete.
- Despite evaluations by police and independent researchers, Māori views about the cultural legitimacy of Te Pae Oranga are unclear.
- Cultural legitimacy is important because when participants see that their culture and worldview is respected, it promotes a sense of healing within communities and contributes to lower reoffending rates compared to prosecution.
- Therefore, further research into the cultural legitimacy of Te Pae Oranga is needed.

Te Pae Oranga Overview

Research Method

- Review literature to determine Māori views on cultural legitimacy of Te Pae Oranga.

Findings

- There currently is no research into understanding how Māori view the cultural legitimacy of Te Pae Oranga.

Next Steps

- Future research could examine how Māori participants of Te Pae Oranga view the cultural legitimacy and validity of the initiative.

References:

SIGNALS OF THE SEA: INTERNAL WAVE DETECTION IN THE BAY OF PLENTY

Bella Muir, Ken Hughes

THE UNIVERSITY OF WAIKATO

Introduction

- Internal waves occur along a density gradient and are caused by a forcing energy such as the tide.
- They can affect nutrient distribution, alter surface temperatures, and damage infrastructure.
- Internal waves cause troughs in surface waves to become rougher due to water convergence and peaks to become smoother due to divergence. This alters the way light reflects off the waters surface, making internal waves visible from space.
- It is unknown if these waves occur frequently in the Bay of Plenty region and the effect that they may have here.
- Satellite methods are useful for learning more about internal waves as they are cheaper and more time efficient than most in-situ methods.

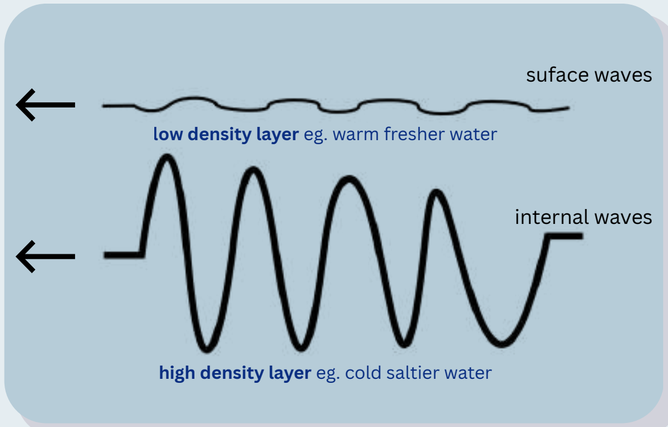


Fig. 1: Internal waves may be tens of metres high while their surface signature is signficantly smaller, often undetectable.

Objectives

- **Do internal waves occur in the Bay of Plenty region?** If so, what conditions lead to them and what are their impacts?
- **Which satellites and databases are most useful for detecting these waves?**

Methods

To investigate internal wave presence the following process was used:

Browsed satellite databases

→ NASA Earthdata Search
→ Copernicus Browser
→ USGS EarthExplorer

Identified useful satellites

→ Sentinel-2 L2A
→ Sentinel-2 L1C
→ Landsat 8/9

Gathered supporting data

→ River discharge rates
→ Wind velocity
→ Bathymetry

After identifying useful databases and satellites, imagery from warmer months (October to April) during 2019-2025 were analysed.

Findings

Internal waves were rarely seen in the Bay of Plenty Region. This may be due to limitations in detection (e.g. <10% cloud cover requirement and satellite passing times) or indicate that internal waves are genuinely rare in this region. Two potential case studies were identified and discussed.

CASE STUDIES

Topography Generated

Internal waves were identified on the 30th and 31st of December 2021 from Mt Maunganui to East Cape. Steep bathymetry and shelf breaks near offshore islands could have favoured their generation and reefs near Ōtāiti and Mōtītī may have caused the internal waves to shoal.

Several packets of internal waves were identified as a series of alternating dark and light bands. The leading waves are the longest and most distinct with decreased wavelengths as the packets proceeds.

These waves will break within the sea's internal layer once they reach shallower water, much like how waves break in the surf zone.

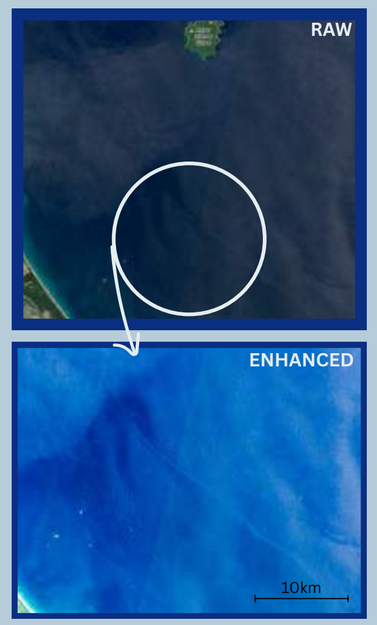


Fig. 2 & 3: Internal wave packets off the coast of Mt Maunganui.

Freshwater Generated

Internal waves were also identified on October 16th 2025. These internal waves were found where Whakatāne and surrounding rivers met the sea. Multiple internal wave packets can be seen, with each packet likely coinciding with successive tide cycles that occurred since heavy rain fall began.

River discharge rates peaked the day before the satellite picture was taken. Heavy rainfall creates freshwater plumes that result in strong density gradients.

Combined with the density gradient, differing velocities of the river and the sea water can trigger internal waves along with tidal forcing.

Fig. 4: Internal waves at the mouth of the Whakatāne River. Note the curved shape of the wave packets here in comparassion to the linear features in Fig. 2 & 3.

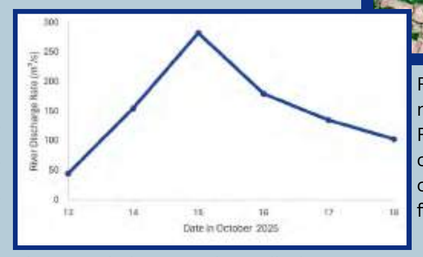


Fig. 5: Whakatāne River discharge rates surrounding internal wave dates.

Waikato's Bacterial Hunters: Early Isolation and Characterisation of Native Bacteriophages

Student: Hinetu Nikora,
Supervisor: Simon Jackson,
Co-supervisor: Deborah Yung
Te Wānanga Waiora | Division of Health

THE UNIVERSITY OF WAIKATO
Te Whare Wānanga o Waikato

Introduction

Antimicrobial resistant (AMR) bacterial pathogens are significant drivers of poor health outcomes within communities, placing significant burdens on health systems worldwide[1].

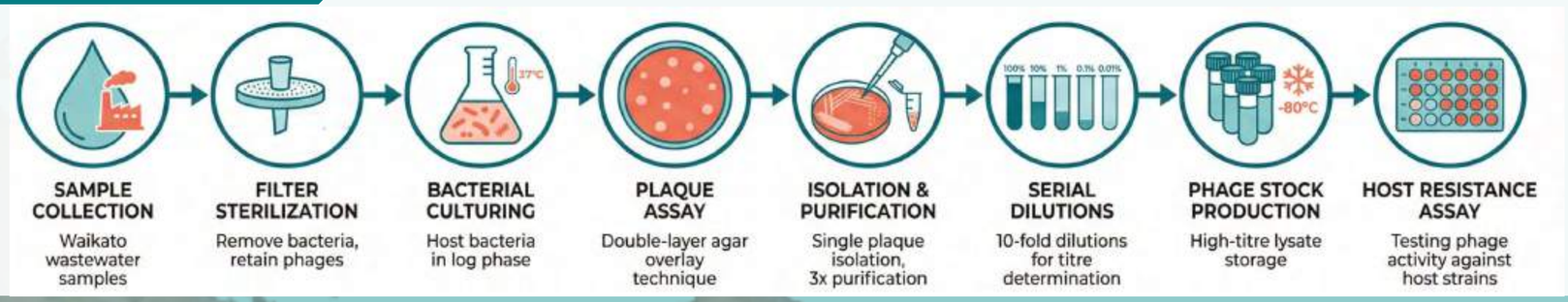
Current efforts for addressing AMR pathogens involve the use of bacteriophages[2] - viruses that target and infect bacteria. These viruses exhibit capacity for seizing host machinery for replication and lytic activity[2].

Investigating phage therapy allows for alternative, tailored treatments towards persistent AMR bacterial pathogens[1].

Research Aim:

Isolate and characterize native bacteriophages against Staphylococcus hosts from wasterwater samples in Aotearoa New Zealand.

Methodolgy – Wet Lab



Results

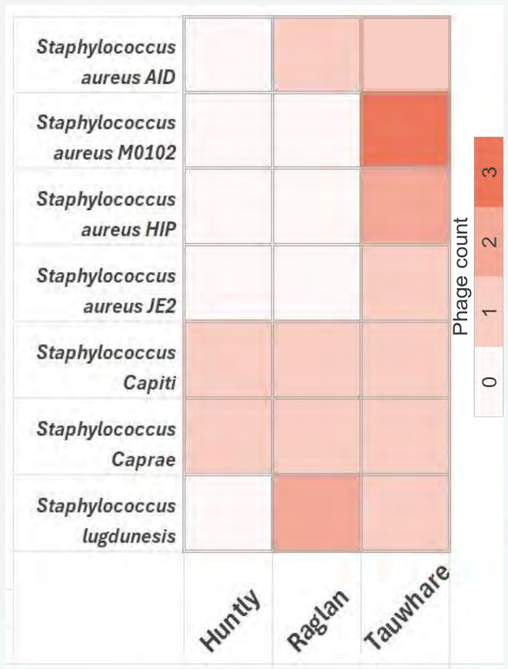


Figure 1: Host range and regional distribution of wastewater-derived bacteriophages against Staphylococcal hosts.

Figure 2: Comparative serial dilution spot assay of diverse bacteriophages (10µl) on S.*aureus* M0102 lawn.

Discussion

- Early isolation efforts demonstrate the presence of phages against commensal and AMR Staphylococcal hosts within Waikato wasterwater treatment sites (Fig. 1).
- The biodiversity of regional phages is host-dependent and site-specific (Fig. 1).
- Plaque morphology of phage isolates were largely characterized as small, round plaques ranging in clarity.
- Initial spot assay (Fig. 2) demonstrates heterogeneity in phage-host interactions and lytic activity.
- Further replicates will help confirm screening of successful phage isolates for downstream analysis.

Next Steps

- Electron-microscopy of phage morphology
- Analysis of evolution of phage-host resistance
- Gene sequencing and bioinformatics
- Phage cocktail assay with successful isolates

References

1.) Organization, W. H. (2022). *Global antimicrobial resistance and use surveillance system (GLASS) report 2022*. World Health Organization. https://www.who.int/publications/i/item/9789240062702
2.) Girma A. (2025). Bacteriophages as an alternative strategy for the treatment of drug resistant bacterial infections: Current approaches and future perspectives. *Cell surface (Amsterdam, Netherlands)*, *14*, 100149. https://doi-org.ezproxy.waikato.ac.nz/10.1016/j.tcsw.2025.100149

In the Zone: Decoding Flow from Wearable EEG

Ezra Palmers · Supervisors: Dr. Mitchell Head and Dr. Anany Dwivedi

Introduction

Flow is an altered state of consciousness characterised by deep focus, a sense of control, and effortless engagement during a challenging task, leading to improved performance.
Flow is difficult to measure objectively during real tasks, often relying on subjective self reporting. Wearable **Electroencephalogram (EEG)** provides a practical way to measure and study brain activity.

Aim

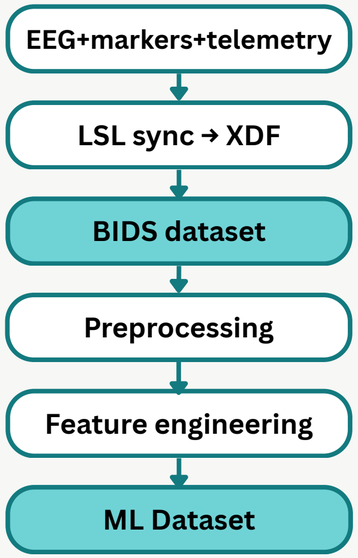
Predict flow state from wearable EEG using interpretable **machine learning (ML)**, and identify EEG signatures associated with flow.

Method

- **Driving simulator:** 20 minute continuous session with a short warmup
- EEG recorded using OpenBCI UltraCortex Mark IV headset
- **Labeling:** button press to mark when the participant exits flow, high confidence flow labels, most data left unlabeled

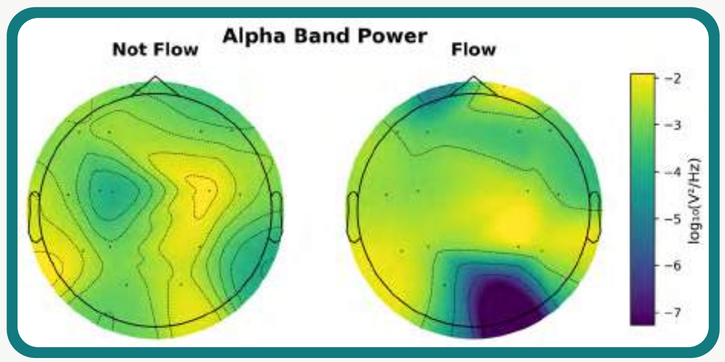
Data Pipeline

Reliable flow/ML results require a defensible data pipeline: consistent synchronisation, standard storage, and reproducible processing.



This end-to-end workflow converts LSL/XDF recordings into a **Brain Imaging Data Structure (BIDS)** dataset, then exports ML-ready datasets via configurable windowing, preprocessing, and feature extraction. It can be readily adapted to other EEG datasets, with task-specific logic mainly limited to label generation.

Results



Topomap of alpha-band power across electrodes for Flow and Non-Flow. We observe a posterior decrease in alpha during flow, consistent with engagement/attention-related alpha suppression.

Machine Learning

Preprocessing: Bandpass → Notch → Artifact removal (ASR) → Re-reference → Normalisation
Features: Time-domain (std, line length) · Spectral (PSD, bandpower) · Connectivity (coherence) · Complexity (entropy) · Region of Interest ratios

In preliminary ML testing, classical models (logistic regression, knn, RBF-SVM, random forest) achieved **53–58%** balanced accuracy. Under strict leave-session-out 5-fold CV with no temporal leakage, SVM and RF performed best. With a reduced feature set, **RF was able to reach 61%.** EEG ML is challenging (low SNR) but these baselines suggest learnable signal for flow state.

Learnings

- Labeling flow is challenging. Self reporting adds bias, and flow can reduce self awareness.
- Our labeling strategy worked well, it allowed high confidence windows around flow-exit events, leaving ambiguous data unlabeled
- Interpretability is essential for understanding what EEG patterns may reflect flow-related brain activity.

Future Work

- **Use unlabeled data** (semi-supervised or pseudo-labeling)
- Model state transitions with a Hidden Markov Model (HMM)
- Experiment with deep learning approaches (EEGNet, CNNs, ViT)

Te Kura Rau Mahara · Royal Society Te Apārangi · The University of Waikato Te Whare Wānanga o Waikato · Waikato Esports · Ministry of Business, Innovation & Employment Hīkina Whakatutuki

Labour Disputes and Access to Finance: Evidence from Unlisted Firms in Southeast Asia

THE UNIVERSITY OF WAIKATO
Te Whare Wānanga o Waikato

01. Introduction

Small and medium enterprises in Southeast Asia are vital to the regional economy but face significant barriers when seeking bank loans due to limited financial track records and lack of collateral. This research investigates whether labour disputes in workplace conflicts between employers and workers, make it even harder for these businesses to access credit. When banks perceive firms as risky due to disputes, they may deny loans entirely rather than simply charging higher interest rates, a phenomenon economists call "credit rationing." Despite the importance of small firms in the region, no prior research has specifically measured how labour conflicts affect loan approvals and collateral requirements in Southeast Asia. This study addresses this gap by using Principal Component Analysis to combine multiple survey responses into composite indices, providing a clearer and more robust measure of credit access.

02. Objective

This research aims to investigate whether firm-level labour disputes reduce credit access for small businesses in Southeast Asia, and whether experienced top managers can help mitigate this negative effect. The study examines how workplace conflicts might worsen information problems between borrowers and lenders, leading banks to ration credit within the unique institutional environment of the region.

03. Methodology

This study uses survey data from unlisted firms in the Philippines and Indonesia, applying Principal Component Analysis to construct composite indices that capture the complex nature of financial access. The method combines related variables into single measures while reducing noise and statistical problems. Three primary indices were created: Finance Infrastructure, which captures external audits and collateral requirements; Bank Financing Intensity, which measures the percentage of working capital and fixed assets funded by banks; and Loan Availability, which integrates perceived barriers, reasons for loan applications, and actual loan outcomes. All survey responses were first standardised to ensure comparability before being combined into these indices.

04. Results/Findings

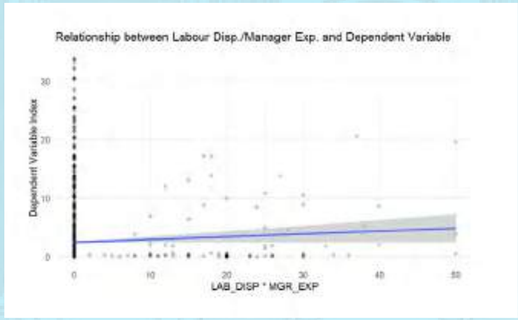
The data shows a sharp two-tier financing environment amongst small Southeast Asian companies. The median bank financing of the working capital and fixed assets is zero implying that most firms are not bank-financed at all. Fewer than 38% of firms have externally audited financial statements, but 77% of those that had them received credit and had to pledge collateral, which indicates great infrastructure deficiencies in formal lending. The discussion reveals that companies are either involved in all the activities of the formal finance at the same time or they are not involved in the banking system at all.

In terms of labour conflicts, companies that had experienced labour conflicts had greater predicted financial limitations on the index (3.2 as opposed to 2.65 in non-dispute companies). This was however not statistically significant (p=0.31) and this implies that disputes alone are not conclusive predictors of credit exclusion in this sample. Rather, other firm attributes turned out to be much more effective predictors of credit access such as quality certifications, innovation activities, and total sales volume (all p<0.001). The analysis also looked at whether the experienced managers would be able to mitigate the adverse effects of disputes, but the moderating relationship was not found to be significant (p=0.14), and the duration and cost of a dispute did not have any measurable effect.

05. Analysis

The first graph, "Labour Disputes and Financial Constraints," visually displays higher predicted constraint levels for firms involved in disputes (approximately 3.2) compared to those without disputes (approximately 2.65), suggesting that labour conflicts may elevate financial barriers. However, despite this apparent difference in the visualization, the underlying regression reveals that this relationship lacks statistical significance. The analysis shows that firm capabilities such as quality certification and innovation are much more important determinants of credit access than the presence of labour disputes.

The second graph, "Relationship between Labour Disputes, Top Manager Experience and Financial Constraints," explores whether management experience can moderate the effect of disputes. Although a slight upward trend is visible, the interaction explains less than 0.15% of the variation in credit access, indicating that broader institutional factors and unobserved firm characteristics play a far more dominant role in determining whether small businesses can access formal credit.



06. Conclusion

This research finds that labour disputes alone do not significantly predict credit rationing among small firms in the Philippines and Indonesia. While disputes may signal production risks to lenders, firm capabilities, innovation, and sales performance are far more powerful drivers of credit access. The actual obstacle seems to be poor financial infrastructure, and most companies are completely locked out of formal banking irrespective of whether they are involved in a dispute or not. Such results indicate that policy interventions aimed at enhancing financial infrastructure and developing firm capabilities can be more effective than those aimed at enhancing dispute resolution.

Acknowledgements

I sincerely thank **Dr. Vijay Kumar** and **Dr. Waqar Akram** for their guidance and support.

References:

Stiglitz, J. E., & Weiss, A. (1981). Credit rationing in markets with imperfect information. *The American Economic Review*, *71*(3), 393–410.

Jolliffe, I. T. (2002). Principal Component Analysis (2nd ed.). Springer.

Filmer, D., & Pritchett, L. H. (2001). Estimating wealth effects without expenditure data or tears: An application to educational enrollments in states of India. Demography, 38(1), 115–132

Vyas, S., & Kumaranayake, L. (2006). Constructing socio-economic status indices: How to use principal components analysis. Health Policy and Planning, 21(6), 459–468.

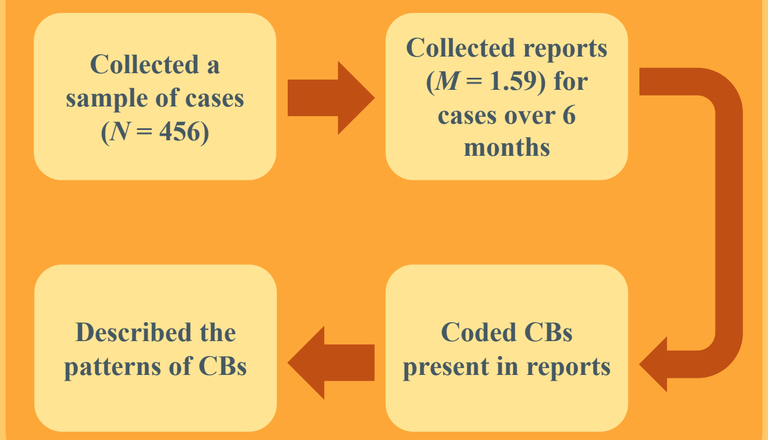
Establishing a Pattern of Coercive Control in Police Reports

Georgia Pollock, Dr Apriel Jolliffe Simpson

Background

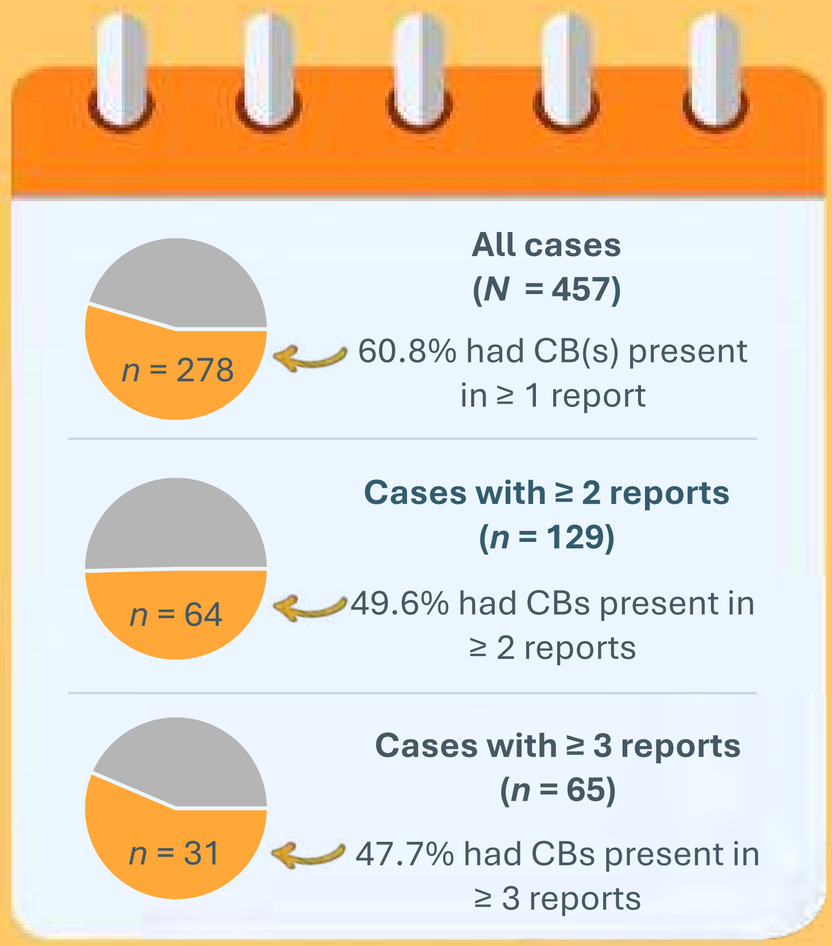
- Coercive Control (CC) is a pattern of Controlling Behaviours (CBs) enacted towards a current or former partner intentionally over time[1]
- Some studies have examined CB in single police reports[2, 3, 4], but it is unclear if a pattern of CB (i.e., CC) can be identified across multiple reports
- Capturing CC is crucial for both quality research and informing agency responses (i.e., prevention and safeguarding)
- We examined whether we could establish a pattern of CBs across police reports for cases in Waikato and Canterbury

Method



Research Question

Can we establish a pattern of coercive control in police reports?



References

1. Hamberger, L. K., Larsen, S. E., & Lehrner, A. (2017). Coercive control in intimate partner violence. *Aggression and Violent Behavior, 37*, 1–11. https://doi.org/10.1016/j.avb.2017.08.003
2. Jolliffe Simpson, A. D., Taaka, S., Polaschek & D. L. L. (2025). Identifying controlling behaviours in police reports for intimate partner violence: implications for risk assessment. *Journal of Family Violence*. https://doi.org/10.1007/s10896-025-00946-6
3. Karystianis, G., Chowdhury, N., Sheridan, L., Reutens, S., Wade, S., Allnutt, S., Kim, M.-T., Poynton, S., & Butler, T. (2024). Text mining domestic violence police narratives to identify behaviours linked to coercive control. *Crime Science*, *13*(1), 2. https://doi.org/10.1186/s40163-024-00200-2
4. Weissflog, M., Ham, E., Jung, S., Kim, S., Eke, A. W., Campbell, M. A., & Hilton, N.Z. (2025). Measuring coercive control from police reports of intimate partner violence. *Journal of Criminal Justice*, *99*, Article 102442. https://doi.org/10.1016/j.jcrimjus.2025.102442

Results

- We established CC (i.e., CBs present across ≥ 2 reports) in 64 cases (14.0% of all cases)
  - 31 cases had CBs in ≥ 3 reports (6.8%)
- Most common CBs in all cases =
  - Smashing property (23.6%)
  - Jealousy/suspicion (22.7%)
  - Threatening physical harm (13.8%)
- In cases with CBs present across ≥ 2 reports, most common CBs =
  - Smashing property (62.5%)
  - Jealousy/suspicion (56.3%)
  - Checking movements (31.3%)
  - Threatening physical harm (31.3%)
- Smashing property, jealousy/suspicion, and threatening physical harm became increasingly common in cases as CBs accumulated across reports

Preliminary Conclusions

- Using police reports, **we could establish a pattern of CB (i.e., CC)**
- Researchers *can* establish and *should* examine this pattern to improve understandings of CC
- Agency responses may be able to recognize and respond to CC using information present in police reports

THE UNIVERSITY OF WAIKATO
Te Whare Wānanga o Waikato

Te Puna Haumaru
Security and Crime Science
THE UNIVERSITY OF WAIKATO

HOW TRAUMA-INFORMED IS OUR UNIVERSITY?

Mapping how trauma and trauma-informed practice are understood and enacted at University of Waikato

INTRODUCTION

More than 70% of people experience at least one potentially traumatic event during their lifetime (Kessler et al., 2017). Yet universities are only beginning to consider trauma as part of equity and inclusion work (Carello & Thompson, 2021). Emerging scholarship on trauma-informed higher education calls for institutions to recognise, respond to, and resist re-traumatisation (Carello & Thompson, 2021; McChesney, 2024; SAMHSA, 2014a; Tsantefski et al., 2020).

7 in 10 People **WILL EXPERIENCE AT LEAST ONE TRAUMATIC EVENT IN THEIR LIFE**

METHODOLOGY

This institutional case study takes a poststructural, critical approach and examines discourses about trauma and inclusion (Andreotti et al., 2016). Data came from:

(1) public-facing university texts (e.g., regulations, policies, student communications)

(2) semi-structured interviews with 11 staff, including practice leaders and trauma scholars. Interviews used story completion with fictional scenarios to elicit likely institutional responses.

FINDINGS

Absence of explicit attention to trauma-informed practice

Across interviews and public-facing documents, trauma is rarely named directly, meaning "trauma-informed" work is more implied than explicitly articulated as an institutional focus. This is consistent with Ahmed's (2012) view that inclusion often remains implied rather than explicit.

Trauma is a reality here, but largely unseen

Participants commonly described trauma as present but largely unseen in everyday university life, with limited shared language or coordinated visibility across the institution. This mirrors findings from other universities where forms of trauma were silenced or invisible (Burke et al., 2025).

Risk-management dominates institutional documents

The desktop review suggests that there is an institutional emphasis on process, compliance, and risk management, rather than an explicitly relational, prevention-focused, trauma-informed framing. This reflects Ahmed's (2021) critique of institutional defaults to procedure, risk and reputation.

Variability: responses depend on individual staff (not systemic)

Where trauma-informed responses do occur, they appear uneven and contingent on individual staff knowledge, attitudes, and roles indicating practice is not systemically embedded across the university. This is problematic as reliance on individual champions produces uneven support (Ahmed, 2012; Williams, 2023).

Strong endorsement of becoming trauma –informed

Despite uneven system-level articulation, interviewees strongly endorsed the relevance and importance of trauma-informed approaches for the university community. This supports wider calls internationally to embed trauma-informed practice across higher education (Carello & Thompson, 2021).

Acknowledged alignment with wider priorities

Some participants connected trauma-informed work to existing priorities and university strategy (e.g., wellbeing, inclusion, equity, student success) These synergies create opportunities for engaging the university community in becoming more trauma-informed. This aligns with Williams (2023): change gains traction when tied to strategy and accountability.

Across the documents and interviews we identified **9** intersecting discourses about trauma and trauma-informed practice.

Political
Relational
Intersectional
Holistic | Indigenous
Health and Safety compliance
Individual Responsibility
Ethic of Care
Performative
Denial

"We need a consistent, top-down, trauma-informed approach—so it's not case-by-case, and students get the same care and response wherever they go"

Interview Participant

WHERE TO NEXT?

There is an opportunity for the University of Waikato to innovate and lead excellent practice by taking an explicit approach to trauma informed practice.

THIS COULD INVOLVE

- **Shared, mana-enhancing trauma-informed foundation**
  Co-develop a shared, mana-enhancing understanding of trauma-informed practice. (Tsantefski et al., 2020).
- **Visible pathways and consistent guidance**
  Make consideration of trauma visible in student-facing communications and create guidelines for staff and institutional response pathways. (Tsantefski et al., 2020; SAMHSA, 2014).
- **Compliance with care: relational, prevention-focused practice**
  Balance procedural/risk requirements with relational, prevention-focused practice to reduce re-traumatisation. (Carello & Thompson, 2021; SAMHSA, 2014a).
- **Student voice as critique**
  Gathering University of Waikato students' accounts of trauma-impacted experiences to surface what is normalised, hidden, or silenced in everyday university practice. *(Marvell & Child, 2023;)*.

REFERENCES

SCAN ME

Arlenna Porteners – Summer Scholar | Division of Education | Katrina McChesney - Supervisor

THE UNIVERSITY OF WAIKATO
Te Whare Wānanga o Waikato

THE UNIVERSITY OF WAIKATO
Te Whare Wānanga o Waikato
NEW ZEALAND

ONE WHĀNAU

ESTABLISHING A BEST PRACTICE BLUE-PRINT FOR INTERPROFESIONAL CASE BASED LEARNING (CBL)

AUTHOR: NGAIO PRINCE - SUPERVISOR: ANNA LATU - TE WĀNANGA WAIORA - THE DIVISION OF HEALTH - THE SCHOOL OF MIDWIFERY

BACKGROUND

CONTEXT: Currently the cases used throughout the Postgraduate Nursing, Pharmacy and Midwifery programs are fragmented and inconsistent in language and structure.

THE CHALLENGE: The reality of Aotearoa's health system means that multidisciplinary collaboration is essential for Whānau-care. The current exclusive approach to CBL throughout Te Wānanga Waiora - The Division of Health does not nurture this necessity, and thus a more interwoven pedagogical method needs to be developed.

AIM: Create and establish an evidence based, Standard Operating Practice template for CBL that can be scaled across and interwoven between the different schools within Te Wānanga Waiora.

METHODOLOGY

LITERATURE REVIEW: An extensive 10-week review of available CBL designs, like those used at The University of Wollongong and St George's in London.

KEY FINDINGS: Effective use of CBL requires a "slow release", this promotes the development of synoptic learning and abstract, critical thought, increasing preparedness of clinical contexts versus textbook theory.

FRAMEWORK DESIGN: Integrate national and international competencies and policy for midwifery with the Hui Process to ensure a well rounded pedagogical approach.

THE CASE FACTORY

THE WHĀNAU PROFILE: A standardised template with focuses on social determinants, national statistics, Rongoā Māori influences, intergenerational connections and current ministry of health focuses.

SLOW-RELEASE INFORMATION: Create a narrative that simulates real life clinical diagnostic processes by "unlocking" the next information through student inquiry/exploration.

THE 'COGS": Each case will identify the professions integrated (Nursing, Midwifery and/or Pharmacy), promoting multidisciplinary understanding, communication and real world preparedness.

IMPACT & EXEMPLARS

RESOURCE GROWTH:

- Expanded the Midwifery CBL library from 4 to 6 standardised cases, as well as a 50% increase in resources.
- "Wiremu & Hine" were developed as a Pharmacy/Nursing cross-disciplinary example.

STANDARD OPERATIONS PROCEDURE:

- Scan the QR code o access the SOP document developed through this project

CONCLUSION:

Standardising CBL across Te Wānanga Waiora will support future-focused curriculum development by providing consistent methods for case design across current and emerging programmes (e.g. Medicine in 2028). A clear framework for case development will enhance consistency, scalability, and specialty-specific skill acquisition, real-world preparedness and interdisciplinary collaboration to improve health outcomes.

GREATEST LEARNING:

This project was surprisingly interesting from a student perspective. The literature findings indicate a need for stronger evidence on the benefits of CBL, improved standardisation of development tools, and greater consistency in implementation, especially within health education. This work has strengthened my interest in CBL within tertiary health education and its potential to improve health outcomes in Aotearoa.

IN THE ZONE

MAPPING BRAIN PERFORMANCE *TO* DRIVING PERFORMANCE

Student: Swapneel RAJ
Supervisors: DR. Mitchell HEAD,
DR. Jemma KÖNIG

INTRODUCTION

Envision always being able to perform at the absolute limit, perfectly in flow state. We aim to achieve just that, by collecting brain and driving performance data and labelling it in parallel during flow states for machine learning to answer:

- **What does the brain look like in flow state?**
- **Do flow states really correlate with improved performance?**

More Information available here!

RESULTS

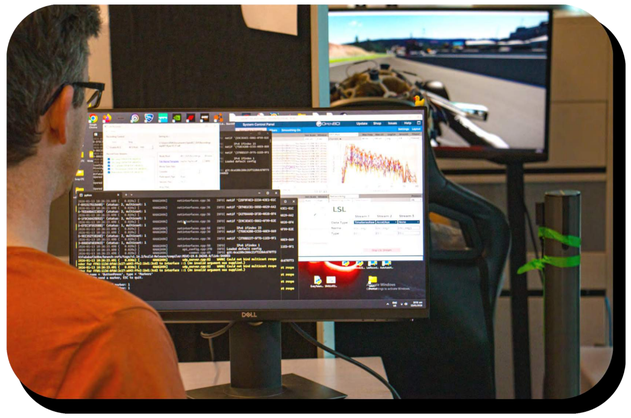
We streamed the driving performance data, the brain (EEG) data, and the parallel labelling data to a file ready for machine learning analysis.

CONCLUSION

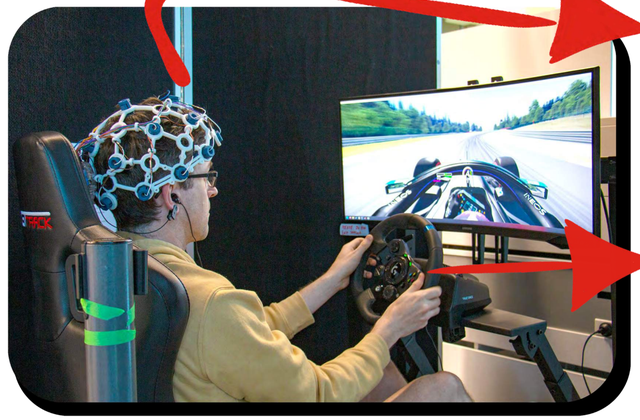
We successfully labelled the brain and performance data in parallel for machine learning analysis and created a pipeline for further data collection.

METHOD

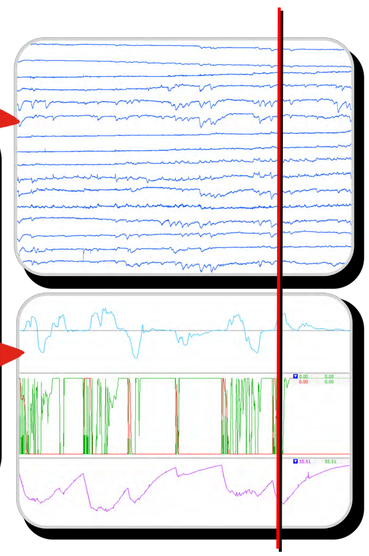
Brain (EEG) data is recorded using OpenBCI's GUI application, which has integrated streaming through Lab Streaming Layer; Assetto Corsa and parallel labelling both require the use of custom Python code. Assetto Corsa Shared Memory is used to access driving performance (telemetry) data and then streamed through Lab Streaming Layer. Those streams are captured and aligned using Lab Recorder, then recorded to a `.xdf` file for machine learning.



Brain (EEG) data, driving performance data, and parallel labelling being recorded.



Driving simulator setup, with the OpenBCI Mark IV Ultracortex.



BRAIN DATA (EEG)

EEG data recorded from the OpenBCI UltraCortex Mark IV headset.

PERFORMANCE DATA

Telemetry data recorded from the Assetto Corsa Simulator.

MARKER

Subjective marker, made by the participant when they feel they have come out of flow state.

Waikato Esports
ROYAL SOCIETY TE APĀRANGI
Te Kura Rau Mahara
THE UNIVERSITY OF WAIKATO Te Whare Wānanga o Waikato
MINISTRY OF BUSINESS, INNOVATION & EMPLOYMENT HĪKINA WHAKATUTUKI

ESTABLISHING A RONGOĀ MĀORI GARDEN FOR INTERDISCIPLINARY HEALTH EDUCATION

A Kaupapa Māori Research Initiative

Author: Chrissy Rangi - Supervisors: Anna Latu & Repeka Crosswell
Te Wananga Waiora - The Division of Health - The School of Midwifery
Illustration by: Jo Ewing

THE UNIVERSITY OF WAIKATO
Te Whare Wānanga o Waikato
NEW ZEALAND

INTRODUCTION

Rongoā Māori is a holistic healing system grounded in mātauranga, whakapapa, and tikanga (Jones et al., 2021; Ministry of Health, 2023). While traditional healing is intimately tied to whenua and whānau, contemporary health education often lacks place-based, culturally safe opportunities for student engagement.

This project establishes a Rongoā Māori Garden as a living mātauranga space for interprofessional learning. Governed by a formal Standard Operating Procedure (SOP), the garden ensures that engagement protects mana whenua authority and mātauranga Māori, providing an ethical and sustainable framework for future health professionals (Hudson et al., 2010)

METHOD

A Kaupapa Māori designed, location-based approach guided the garden's establishment. Central to this methodology was the development of a formal Standard Operating Procedure (SOP) to govern the organisation, administration, and cultural safety of the space.
Key developmental phases included:

- Wānanga & Consultation: Direct engagement with Ngāti Wairere, kaumātua, and kaitiaki to ensure all protocols align with local tikanga and mana whenua authority.
- Spatial & Species Design: Selection of Waikato-appropriate rongoā species (e.g., Kawakawa, Harakeke) and an eastern-facing layout to acknowledge renewal. First offerings from the mārā to be given back to the kowhai tree which is central and the mauri of the Rongoā garden
- Administrative Framework: Designing the SOP to manage interprofessional education (Nursing, Midwifery, Pharmacy) and integrate digital tools, such as QR-coded governance links, for sustainable teaching.

RESULTS & FUTURE DIRECTIONS

A Blueprint for Establishment.
This project delivers a three-part framework to the PVC and Associate Dean Māori for the formal integration of the Rongoā Garden into the Division of Health.

- Outcome 1: The Living SOP A robust governance framework ensuring Cultural Continuity (Ngāti Wairere tikanga) and Interprofessional Synergy between Nursing, Midwifery, and Pharmacy.
- Outcome 2: Physical Design Proposal A formal submission for the garden's layout, centered on an eastern-facing orientation and theKōwhai (Mauri tree) to anchor the space.
- Outcome 3: Clinical Implementation A roadmap for embedding rongoā-based "trigger points" into the clinical curricula, utiliSing the garden as a formal space for collaborative, contextually responsive care.

Rongoā Teaching Framework:
Scan for administrative documents and cultural safety frameworks.
This QR code ensures all teaching is organised according to approved Tikanga and University Protocols.

References:

Hudson, M., Milne, M., Reynolds, P., Russell, K., & Smith, B. (2010). *Te Ara Tika: Guidelines for Māori research ethics*. Health Research Council of New Zealand.
Jones, R., Bennett, S., Keating, G., & Blaiklock, A. (2021). Māori health and the limits of biomedical frameworks. *New Zealand Medical Journal, 134*(1539), 9–18.
Ministry of Health. (2023). *Cultural safety, partnership, and equity in the health workforce*. Manatū Hauora.

IMU Sensor Positioning in Calf-Raise Tests

THE UNIVERSITY OF WAIKATO
Te Whare Wānanga o Waikato
TAURANGA

Introduction:

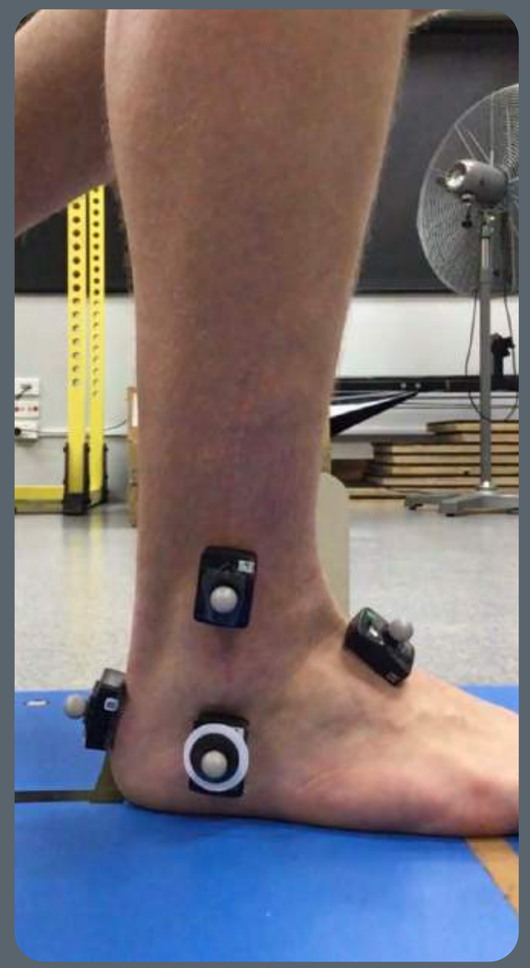
Wearable sensor technology is becoming increasingly more in demand for sporting applications.[1] IMU sensors are an effective form of wearable sensor for sports-based practices.[1]

Project Aim:

The aim of this project was to find the most optimal IMU sensor position during a calf raise movement that provides the most reliable and valid data.

Methodology:

6 IMU sensor positions were selected, for during the calf-raise tests, on flat and inclined surfaces. Videos were used for Calf-raise app, used as the gold standard.



Results:

Sensors - The heel IMU sensor position showed the highest reliability.

Gravity removal - Accuracy of removing gravity will impact the overall reliability and validity of the data. Small errors in removal will be inflated .

To have an accurate sensor position gravity must be removed to ensure pure and accurate data.

Conclusion:

The heel IMU sensor showed the highest reliability. Accurate gravity removal is essential because even small errors are inflated and reduce the reliability and validity of the data. Therefore, gravity must be properly removed to ensure sensor measurements reflect pure motion data and not gravity influenced.

References:

[1]Linnamo, V. (2023). Sensor technology for sports monitoring. Sensors, 23(2), 572.
[2] Madgwick orientation filter — AHRS 0.4.0 documentation. (2019). Read the Docs. https://ahrs.readthedocs.io/en/latest/filters/madgwick.html

Poster by Tyzak Rhind
Supervised by Zane Hamilton

Special thanks to Associate Professor Kim Hebert-Losier

Acknowledgements - The University of Waikato

EXPANDING THE GENETIC CODE: IMPROVING THE ACCURACY OF PROTEIN ENGINEERING IN BACTERIA

THE UNIVERSITY OF WAIKATO
Te Whare Wānanga o Waikato

AUTHORS

Aria Rhodes, Kevin Beijerling and
Dr William Kelton

INTRODUCTION

Proteins are essential molecules that carry out most biological processes and are widely used in medicine, biotechnology, and research. They are normally constructed from 20 standard amino acids, limiting the range of chemical properties that proteins can possess. Expanding this set of building blocks offers new opportunities to create proteins with enhanced or entirely new functions [1].

One way to achieve this is by using engineered bacteria to incorporate non-canonical amino acids, amino acids from outside the normal 20, into proteins at specific positions [2]. This is done by introducing orthogonal aaRS/tRNA pairs, which recognise a genetic "stop" signal and insert a new amino acid instead of ending protein production [3]. This approach allows us to precisely control where new chemical features are added within a protein.

PROBLEMS

Enzyme promiscuity

The specialised enzyme designed to attach the new amino acid is sometimes not fully selective. Instead of using only the intended non-canonical amino acid, it can occasionally attach a standard amino acid. This allows protein production to continue even when the new building block is absent, leading to unintended protein expression.

Misreading of genetic stop signals

The genetic "stop" signal used to insert the new amino acid is not always interpreted correctly by the cell's protein-making machinery. In some engineered bacteria, this signal can be ignored, allowing protein synthesis to continue using standard amino acids. This further contributes to background protein production when it should not occur.

OBJECTIVE

1. To determine the contribution of enzyme selectivity to unwanted protein production
   - By assessing how specialised enzymes handle standard versus new amino acid building blocks under different conditions.

2. To evaluate how genetic stop signals are interpreted during protein production
   - By comparing bacterial strains with different translation machinery to understand when protein synthesis continues incorrectly.

METHOD

Bacterial strains & proteins
- Engineered bacteria (B95) and a standard control strain (C41) were used to produce a fluorescent protein (sfGFP), including a version requiring a non-canonical amino acid.

Always-on expression system (pDule2)
- The pDule2 plasmid, which continuously produces the protein-making machinery for inserting the special amino acid, was used in all test conditions.

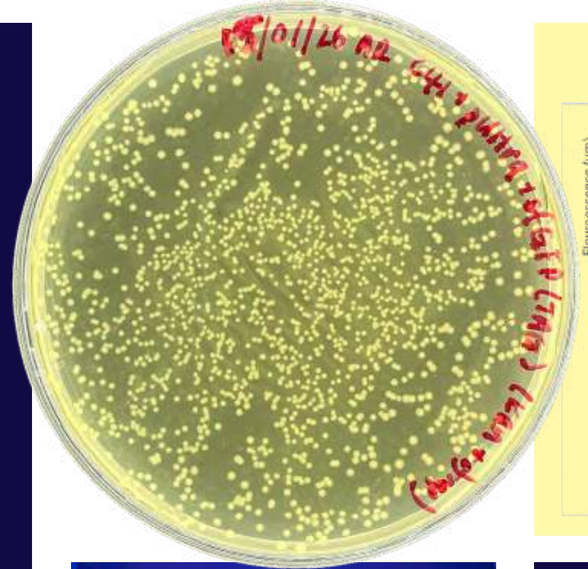
Growing the bacteria
- Bacteria were grown overnight, then transferred to fresh media and allowed to grow until they reached the same cell density.

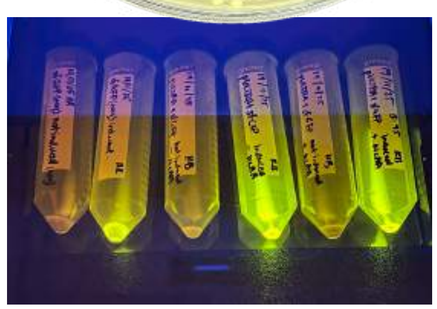
Turning protein production on and off
- Protein production was switched on using a chemical inducer (IPTG).
- The special (non-canonical) amino acid was added only to selected samples.

Protein expression
- Once induced, cultures were grown at a lower temperature overnight to allow the fluorescent protein to form.

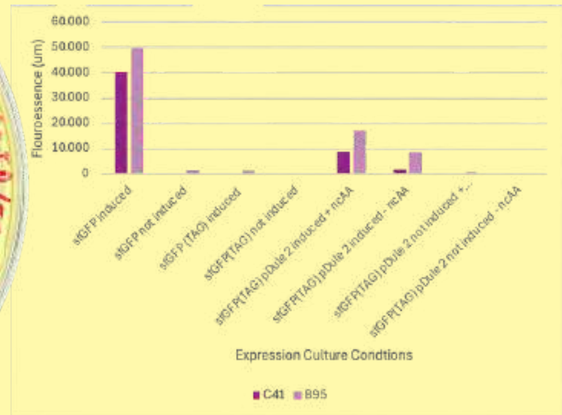
Preparing samples
- All cultures were adjusted to the same cell concentration before collection, ensuring fair comparison between samples.

Measuring results
- Fluorescence was measured to compare how much protein was produced under each condition.





RESULTS



- Protein production is mostly controlled, but not perfect, as some fluorescence is still detected under conditions where expression should be minimal.
- sfGFP expression can be reliably switched on in both C41 and B95 strains, showing that the asic control system functions in both backgrounds.
- Adding the non-canonical amino acid leads to higher fluorescence, indicating more complete and correct protein production.
- B95 consistently produces stronger fluorescence than C41, suggesting it is more efficient and prone to fewer errors during protein synthesis.
- Residual fluorescence without the non-canonical amino acid confirms background expression, likely due to occasional mistakes during protein production.
- The system can successfully produce fluorescent proteins using a non-standard amino acid, but background expression still occurs; adding the non-canonical amino acid improves accuracy, and the B95 strain performs more reliably than C41.

CONCLUSION

- This study focused on pDule2, showing constant "always-on" expression works well, but a switch-controlled system may reduce unwanted background signal. Therefore, future experiments comparing constitutive (pDule2) versus inducible (pUltra) systems will help determine whether tighter control can reduce background protein expression.
- Only the full-length pCNF-RS was tested here. Testing truncated, higher-fidelity variants may improve specificity for the non-canonical amino acid and reduce unintended amino acid incorporation.
- Background expression suggests timing matters. Optimising when the non-canonical amino acid is added (before vs after induction) may increase correct incorporation and lower read-through.
- Future application: viral biosensing. Improved non-canonical incorporation could enable engineered nanobodies for viral detection. This opens the door to a multidisciplinary biosensor platform, combining synthetic biology, protein engineering, and diagnostics.

[1] T. G. Castro, M. Melle-Franco, C. E. A. Sousa, A. Cavaco-Paulo, and J. C. Marcos, "Non-Canonical Amino Acids as Building Blocks for Peptidomimetics: Structure, Function, and Applications," 2023. doi: 10.3390/biom13060981.
[2] B. K. Jin, S. Odongo, M. Radwanska, and S. Magez, "NANOBODIES®: A Review of Generation, Diagnostics and Therapeutics," Int. J. Mol. Sci., vol. 24, no. 6, 2023.
[3] T. Mukai, M. J. Lajoie, M. Englert, and D. Söll, "Rewriting the Genetic Code," 2017. doi: 10.1146/annurev-micro-090816-093247.

BRIDGING CURIOSITY:
Engineering Safety in Design (SiD)

Romy Rigo Napoli - Supervisors: Arthur Fang, James Lim

THE UNIVERSITY OF WAIKATO
Te Whare Wānanga o Waikato

1 BACKGROUND

In 2024, the University of Waikato developed a 12-metre mobile cable-stayed bridge as part of New Zealand's Bridges to Schools Engineering Programme, aimed at inspiring the next generation of engineers in response to the country's engineering skills shortage.

The bridge travels to schools nationwide, where students collaboratively assemble the structure and explore engineering concepts through hands-on, interactive learning[1].

2,300
Annual engineering shortfall in NZ[2]

1.8%
NZ school-aged students pursuing engineering careers[2]

2
Existing mobile outreach bridges in NZ

Bridge 1

Designed by AUT supported by ICE Fletcher & others[1]

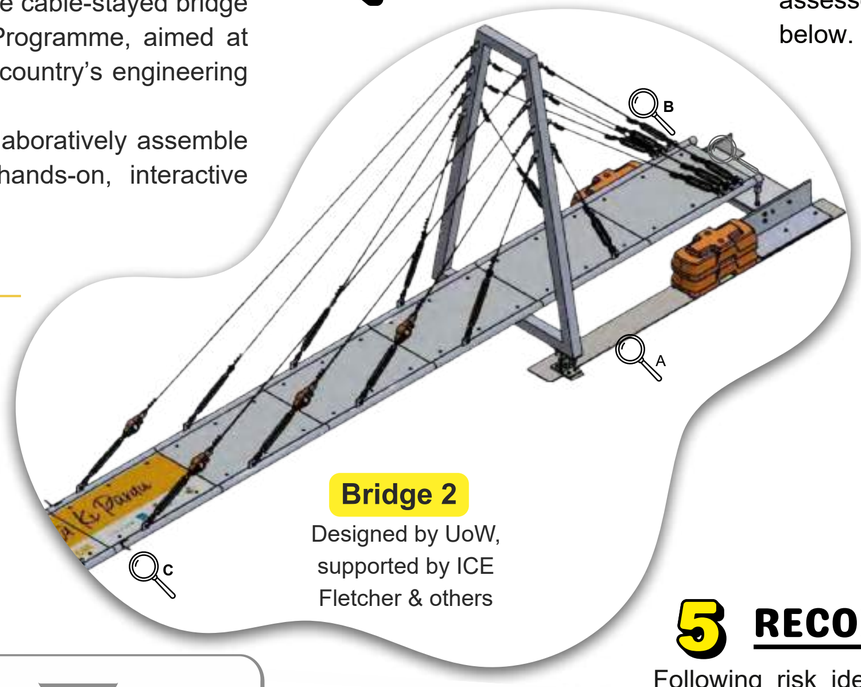
2 AIM

This project aims to develop design insights from Bridge 2 and propose **Safety-in-Design (SiD)** recommendations that address identified health and safety risks, to inform the future design and construction of Bridge 3 while maintaining safe, hands-on educational engagement for school students.

3 METHOD

- Reviewed existing bridge concepts
- Observed student engagement during school-sessions
- Collected user feedback
- Developed a Risk Register

Fig. 1 - Ngākōroa School student walking the bridge



Bridge 2

Designed by UoW, supported by ICE Fletcher & others

Fig. 2- Ngākōroa School students assembling the bridge

Safety + Engineering + Education = Inspired Futures

4 DESIGN INSIGHTS

From the eighteen identified health and safety risks during assembly, nine were assessed as moderate to high using NZS ISO 31000 as guidance and are outlined below.

Lifting and Handling

- Heavy steel base plate: risk of finger crush (A)
- Heavy cables for students to carry
- Exposed cable-ends pose a risk of cuts (B)

Assembly

- Limited visual alignment guides
- Difficulty aligning both sides of the bridge in the middle
- Sliding pin poses a poke hazard to the leg (C)

Stability & Transport

- Bridge wobble and sway during walking
- Welded aluminium O-ring connector showing signs of failure
- Loss of small components increases time and errors

5 RECOMMENDATIONS FOR Bridge 3

Following risk identification and assessment, SiD mitigation strategies were developed to eliminate or mitigate identified hazards.

- **Redesign for a lighter base** with timber:
  - Bigger footing
  - "H" shape base
  - Timber step casing
  - Add 2 timber beams enabling mid-span cable anchorage
- Decrease **cable** diameter **under safety factors**
- **Add protective sleeves** prior to securing cables

- Integrate **colour coded features**
- Add a marked **assembly tarp** with predefined reference distances
- Modify sliding pin to face downward during use

- Increase stability using additional **cables anchored** to the base
- Replace aluminium connectors with stronger **steel** components
- Use fasteners that remain attached to prevent parts being lost

6 CONCLUSION

Observations and safety insights gained from Bridge 2 informed the identification of key hazards and the development of targeted design recommendations for Bridge 3.

These changes aim to reduce safety risks while maintaining hands-on educational engagement, supporting the project's goal of delivering a safer learning experience for school students.

ACKNOWLEDGEMENTS

University of Waikato Summer Research Programme, Kimi Wang, Fletcher Construction, Brian Perry Civil, Lucus Mactier, with special thanks to the Ngākōroa students and teachers.

References: 1. Fletcher Construction. (n.d.). Retrieved from Bridges to Schools: https://www.fletcherconstruction.co.nz/bts; 2. Engineering New Zealand. (n.d.). Retrieved from Long-term skills shortage - Action Plan 2025: https://www.engineeringnz.org/programmes/advocacy/long-term-skills-shortage-action-plan-2025/ (Photographs on poster used with parental consent via Fletcher)

Rate This Place

Building a Citizen Science App for Community Feedback

Supervisors
Annika Hinze
Nic Vanderschantz

Poster
Samuel Rili

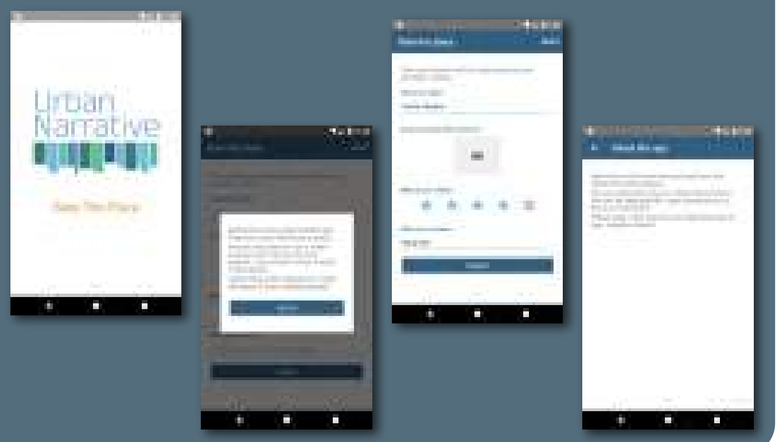
THE UNIVERSITY OF WAIKATO
Te Whare Wānanga o Waikato

Background

The collection of user locational data has been used for a variety of different purposes and can help enhance the daily life of people and their engagement with different places. The use of this type of technology can be observed in a wide variety of media and is used almost daily.

Aim

This project aims to explore how people engage with and understand everyday places and locations, looking into motivations, perceptions, moods and attitudes towards these different places. After understanding this range of user perceptions, to then refine and develop effective visualisations of this type of information for an app developed prior.



Methodology

To gain insights into how people engage with different spaces, the use of an **auto-ethnographic study** alongside a **diary study** was utilised. These research methods in conjunction with each other provided detailed insights into how we as people look at and engage with different places.

Auto-Ethnography

This form of study involves the documentation of the researchers daily life in relation to their specific field of research. This form of study is effective as "[it] specialise[s] in studying social and cultural phenomena cover[ing] a broad spectrum of engagements with a clear focus on technological aspects" [1]

Diary Study

Diary studies provide a structured in-situ form of documentation that allows a more refined way of understanding the data.
Auto-Ethnographies can occasional drift into personal narrative, by utilising this research method, information being documented would remain grounded in research.

Results

As a way to get a better understanding of the way the researcher engages with the different locations visited. Various forms of media was utilised: Photography, Video, Audio Recording, Text Entry.

The use of various media formats provide an additional layer of information that would help inform future decision when designing engaging visualisations and interfaces.

Outcomes and Future Work

The collection of user data and the way the researcher has engaged with these locations has provided valuable information in the way we understand the space around us. As information continues to be documented and processed, an iterative design process would be taken to then develop visualizations for the collected information, designing engaging ways to display this information; being done in a way that ensures ease of use and understanding.

References

[1]Kaltenhauser, A., Stefanidi, E., & Schöning, J. (2024). Playing with Perspectives and Unveiling the Autoethnographic Kaleidoscope in HCI – A Literature Review of Autoethnographies. Proceedings of the CHI Conference on Human Factors in Computing Systems, 1–20. https://doi.org/10.1145/3613904.3642355

Photo by UX Indonesia on Unsplash

Diagnosing Smarter:

Strengthening RA Case Identification in Healthcare Data

Authors: Jamal Roberton, Douglas White, Vicki Quincey, Andrew Soepnel, and Chunhuan Lao (lead supervisor)
Te Huataki Waiora School of Health, University of Waikato, New Zealand

Introduction

Rheumatoid arthritis (RA) is a chronic autoimmune inflammatory disease associated with substantial morbidity and increased all-cause mortality.[1,2] Early diagnosis and initiation of disease-modifying antirheumatic drugs (DMARDs) improves long term outcomes and reduces disease burden.

Accurate identification of RA cases within routinely collected healthcare data is essential for disease surveillance, service planning, and epidemiological research. However, real-world datasets are vulnerable to misclassification due to inconsistent diagnostic coding, non-specific DMARD use, and varying rheumatology specialist involvement.[3]

In Aotearoa New Zealand, primary health organisation (PHO) databases like the Pinnacle Midlands Health Network contain large volumes of patient data, yet no validated approach exists to identify RA cases using primary care classification codes. This limits the reliability of research and population-level estimates derived from these datasets.

Aim

To validate the accuracy of SNOMED-coded RA diagnoses in primary care records using rheumatology specialist involvement, DMARD treatment history, and RA-specific serology, and to develop a scalable validation framework for use in Aotearoa New Zealand.

Methods

Study Design: Retrospective diagnostic validation study

Setting: Midlands region of Aotearoa New Zealand (Waikato, Bay of Plenty, Lakes, Tairāwhiti, Taranaki)

Data Sources:

- Pinnacle Midlands Health Network – Patient demographics and DMARD exposure
- Pathlab – RA-specific serology (Rheumatoid Factor/RF and anti-cyclic citrullinated peptides/aCCP)
- Waikato Hospital databases – Rheumatology specialist involvement, review of equivocal cases and those with incomplete data

Population: Patients with a SNOMED diagnostic code for RA recorded in the Pinnacle Midlands Health Network databases between 1 January 2018 and 31 May 2025

Validation framework:

1. Rheumatology specialist involvement (link to M70 service code)
2. DMARD exposure (conventional or biologic)
- Methotrexate, Sulfasalazine, Leflunomide, Hydroxychloroquine, TNF inhibitors, other biologics
3. RA-specific serology
- Positive: RF>50 IU/mL, and/or aCCP>100 IU/mL
- Possible seropositivity: 25<RF<50 IU/mL, and/or 20<aCCP<100 IU/mL
- Negative: RF<25 IU/mL, and/or aCCP<20 IU/mL
4. Random sample of patients lacking specialist involvement, DMARD exposure, and serology data
5. Independent record review, with dual specialist appraisal for equivocal cases

Additional internal validation: Random sampling to assess accuracy of DMARD-based RA classification

Statistical Analysis: Conducted using Microsoft Excel and IBM SPSS Statistics Version 31. Positive predictive value (PPV) calculated using validated RA diagnosis as the gold standard

Ethics Approval: Northern B Health and Disability Ethics Committee (2024 EXP 20314)

Results

- 3,306 / 3,831 patients confirmed RA
- PPV: 86.3% (95% CI: 85.2-87.4%)
- 523 (13.7%) no RA
- 2 (0.05%) remained inconclusive

Internal validation of DMARD-based classification:

- RA confirmed in 88% of DMARD-exposed patients with specialist involvement
- RA confirmed in 80% of DMARD-exposed patients without specialist involvement

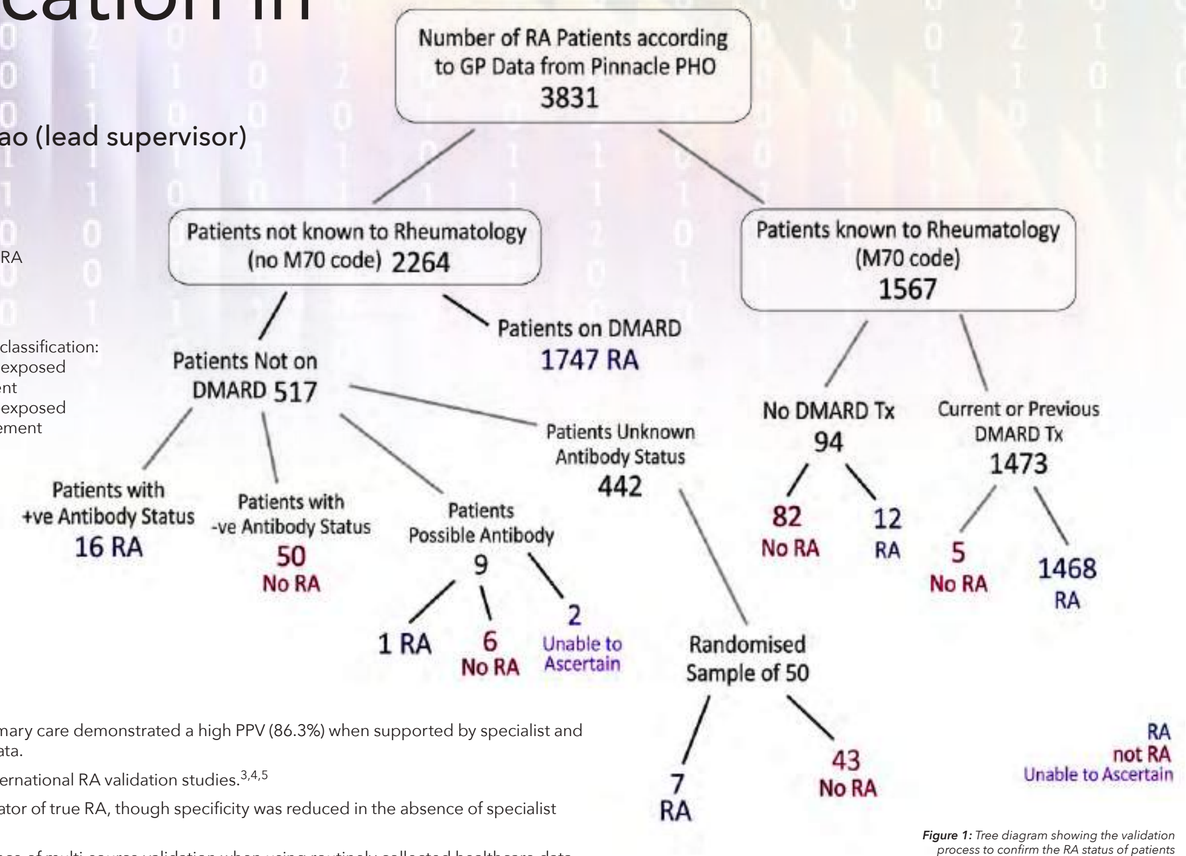


Figure 1: *Tree diagram showing the validation process to confirm the RA status of patients according to primary care data from the Pinnacle Midlands Health Network*

Discussion

SNOMED-coded RA diagnosis in primary care demonstrated a high PPV (86.3%) when supported by specialist and DMARD exposure, and serological data.

These findings are consistent with international RA validation studies.[3,4,5]

DMARD exposure was a strong indicator of true RA, though specificity was reduced in the absence of specialist involvement.

These findings highlight the importance of multi-source validation when using routinely collected healthcare data.

Misclassification of RA in primary care records may distort estimates of disease burden, treatment coverage, and ethnic and geographic inequities in access to rheumatology care.

Limitations:

- Validation relied on available specialist, DMARD, and serological data. Incomplete data for some patients required random sampling and specialist judgement
- Retrospective design
- Use of pragmatic proxies for RA diagnosis
- Lack of systematic assessment of false-negative cases

Conclusion

A structured, hierarchical validation approach substantially improves the accuracy of RA case identification in primary care datasets. This framework enables more reliable use of primary care data for epidemiological research, health service planning, and future studies of RA in Aotearoa New Zealand.

Arthritis NZ
Mateponapona Aotearoa

THE UNIVERSITY OF WAIKATO
Te Whare Wānanga o Waikato

References

1. World Health Organisation. (2023). Rheumatoid arthritis. Retrieved December 10, 2025, from https://www.who.int/news-room/fact-sheets/detail/rheumatoid-arthritis
2. Farquhar, H.J., Huria, T., Beckert, L., Frampton, C.M.A, Haslett, J., & Stamp, L.K. (2025). Incidence, prevalence and mortality of rheumatoid arthritis in Canterbury, Aotearoa New Zealand. Intern Med J, 55(7), 1161-1168. https://doi.org/10.1111/imj.70068
3. Kim, S.Y., Servi, A., Polinksi, J.M., Mogun, H., Weinblatt, M.E., Katz, J.N., & Solomon, D.H. (2011). Validation of rheumatoid arthritis diagnoses in health care utilization data. Arthritis Res Ther, 13(32). https://link.springer.com/article/10.1186/ar3260#citeas
4. Almutairi, K., Inderjeeth, C., Preen, D.B., Keen, H., Rogers, K., & Nossent, J. (2021). The accuracy of administrative health data for identifying patients with rheumatoid arthritis: a retrospective validation study using medical records in Western Australia. Rheumatology International, 41, 741-750. https://doi.org/10.1007/s00296-021-04811-9
5. Waldenlind, K., Eriksson, J.K., Grewin, B., & Askling, J. (2014). Validation of the rheumatoid arthritis diagnosis in the Swedish National Patient Register: a cohort study from Stockholm County. BMC Musculoskelet Disord, 15(432). https://doi.org/10.1186/1471-2474-15-432

A Squirt of Diversity: Investigating the Genetic Relationships of Antarctic Sea Squirts (Ascidiacea)

Sebastian Ross, Ellie Parvizi

THE UNIVERSITY OF WAIKATO
Te Whare Wānanga o Waikato

INVASOMICS LAB

Introduction

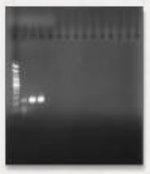
Antarctic ascidians represent a largely understudied group of organisms, despite their important ecological roles in polar marine ecosystems. They are abundant throughout Antarctic marine environments, where they function as major filter feeders, nutrient cyclers, habitat-forming species, and prey for higher trophic levels. However, substantial knowledge gaps exist in our understanding of the diversity, distribution, and biology of this unique group. The concern surrounding these knowledge gaps is exacerbated given the rapid environmental changes occurring in Antarctica due to the effects of anthropogenic climate change.

This study aims to address these knowledge gaps by investigating the phylogeny and genetic relationships of this group. This information is essential for an in-depth understanding of their evolutionary history, genetic vulnerability to environmental changes, and the development of informed management strategies that preserve both these species and the ecosystems they support.

Methods

1. DNA was extracted from ascidian samples (n = 34) collected from the Ross Sea, Antarctica.

2. The mitochondrial cytochrome c oxidase subunit I (COI) gene was amplified from the extracted DNA using PCR with primers specific to regions of the COI gene.



3. PCR products were run on agarose gels to ensure correct gene amplification, and that suitable PCR products were sequenced.

4. Bioinformatics tools, such as BLAST, MEGA, and Hapsolutely were used to analyse the sequenced samples.

Results

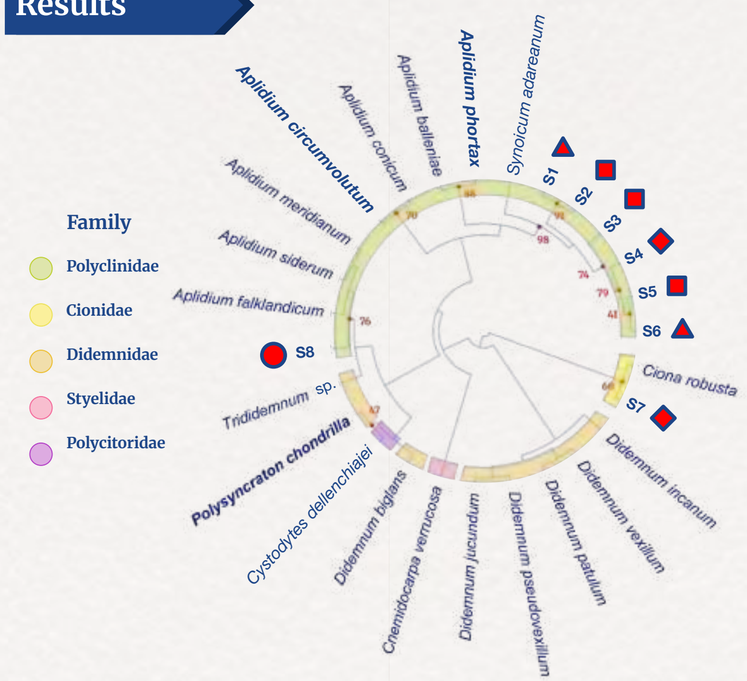


Fig. 1. Maximum-likelihood phylogenetic tree of ascidians inferred from COI sequences, including reference sequences and study sequences (in bold, successful sequences n = 11, symbols indicate sampling locations shown in Fig. 3). Coloured outer bands denote family-level taxonomy (see key). Red numbers at internal nodes represent bootstrap support values (% of replicates). Branch lengths are not proportional to genetic distance.

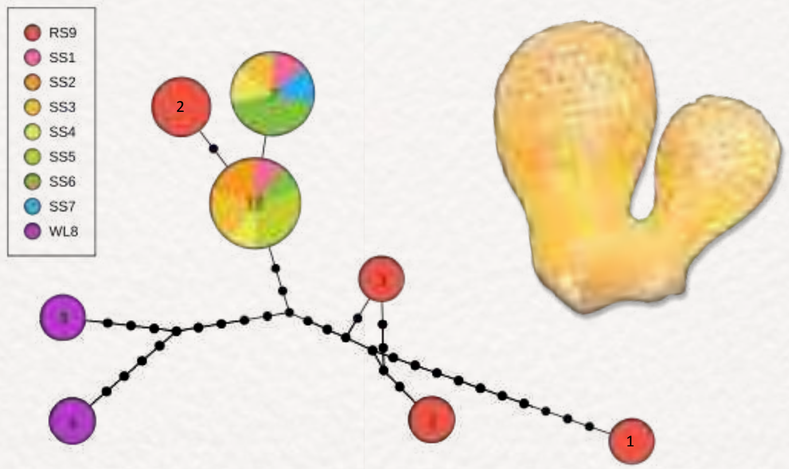


Fig. 2. Haplotype network of *Synoicum adareanum* populations from Antarctica (RS = Ross Sea, SS = South Shetland Islands, WL = Wilkes Land), inferred from a 53 bp region of the COI gene shared among publicly available and newly generated samples. **Inset:** hand-painted illustration by the author showing a representative *S. adareanum* colony.

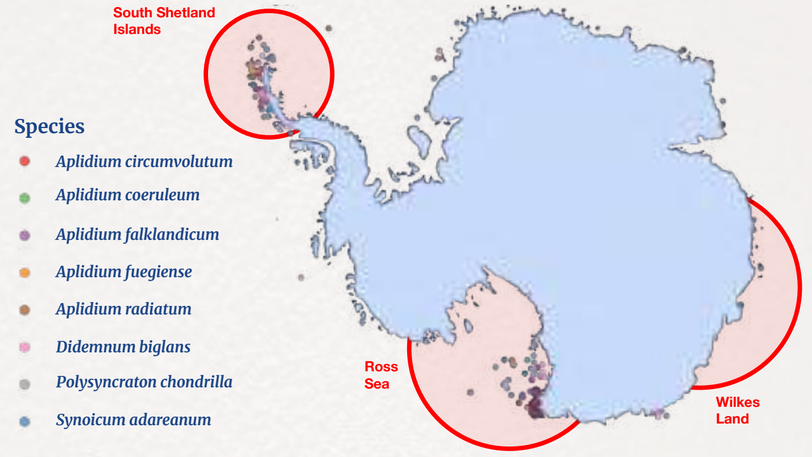


Fig. 3. Occurrence map of Antarctic ascidian species based on records from World Register of Marine Species (WoRMS) Editorial Board (2026). Red areas correspond to the geographic regions shown in Fig. 2. Sampling locations of the study samples are indicated by red-filled symbols with blue outlines (see Fig. 1).

Discussion

- Sequenced samples showed a high occurrence of the species *S. adareanum* (Fig. 1).
- Didemnidae formed a polyphyletic lineage, suggesting either uncertainty within the tree construction (potentially due to missing intermediate relatives), or a need for taxonomic revision (Fig. 1).
- *S. adareanum* showed genetic differentiation among investigated populations, likely due to limited gene flow resulting from the large distances between locations and the species' benthic nature (Figs. 2 and 3).
- This intraspecific genetic differentiation could indicate the presence of cryptic species within *S. adareanum*, although further research would be required to confirm this.

This study highlights substantial knowledge gaps in the genetic diversity and population structure of Antarctic ascidians. Challenges encountered during DNA extraction, amplification, and sequencing reflect difficulties associated with applying molecular techniques to ascidians. Future studies would benefit from the development and application of improved methodologies to better resolve genetic relationships within this group.

References

Segelken-Voigt, A., Bracher, A., Dorschel, B., Gutt, J., Huneke, W., Link, H., & Piepenburg, D. (2016). Spatial distribution patterns of ascidians (Ascidiacea: Tunicata) on the continental shelves off the northern Antarctic Peninsula. *Polar Biology*, *39*(5), 863–879. https://doi.org/10.1007/s00300-016-1909-y

Monniot, F., Dettaï, A., Eléaume, M., Cruaud, C., & Améziane, N. (2011). Antarctic Ascidians (Tunicata) of the French-Australian survey CEAMARC in Terre Adélie. *Zootaxa*, *2817*, 1–54. https://doi.org/10.11646/zootaxa.2817.1.1

THE LANGUAGE BARRIER: PELA

BACKGROUND

Many multilingual students require **academic language support** to succeed at university. Research suggests that post-entry language diagnostic assessments can identify at-risk students and **improve academic outcomes** when linked to targeted interventions (Read & von Randow, 2013). In 2020, the University of Waikato introduced the **Post-Entry Language Assessment (PELA)**, yet its long-term impact has not been systematically evaluated. This research examines how early identification of English language needs and participation in support services relate to academic success, persistence, and student experience at the University of Waikato.

AIM

This project aims to generate evidence that will inform institutional practice and **guide future decisions about language support** at Waikato, particularly regarding the voluntary nature of the PELA assessment and uptake of recommended support services, including ENSLA (English as an Additional Language papers).

METHODS

A mixed-methods approach was adopted:

Quantitative

- Data was extracted from the University of Waikato's SITS and CRM systems for 787 students invited to complete PELA between 2020-2025 on the basis that their first language was not English.
- Extracted variables included PELA outcomes, student engagement with support services, GPA, course pass rates, and retention/attrition status.

Qualitative

- One 60-minute focus group with 5 international students who had been studying at the University for a minimum of 6 months and had engaged with learning support services. Participants' experiences of PELA, academic challenges, and support pathways were explored, with transcripts analysed using thematic analysis.

REFERENCES

1. Read, J. (2008). Identifying academic language needs through diagnostic assessment. Journal of English for Academic Purposes, 7(3), 180–190. https://doi.org/10.1016/j.jeap.2008.06.003
2. Read, J., & von Randow, J. (2013). A university post-entry English language assessment: Charting the changes. International Journal of English Studies, 13(2), 89–110. https://doi.org/10.6018/ijes/2013/2/149231
3. Read, J. (2015). Issues in post-entry language assessment in English-medium universities. Language Teaching, 48(2), 217–234. https://doi.org/10.1017/S0261444813000019

PRELIMINARY RESULTS

While data is incomplete due to unforeseen institutional delays, a preliminary **quantitative analysis** reveals many emerging patterns:

- Most students' overall entry level of English fell within the **intermediate level** range (B1-B2 on the CEFR Scale; 4.0–6.5 on the IELTS Scale). B1 is significantly **below the university's minimum entry requirement** of B2 (IELTS 6.0) for both undergraduate and postgraduate study.
  - Since PELA does not affect enrollment, some students may not have taken the diagnostic seriously.
- The **PELA test completion rate was low**: 20.5% (161 students) completed the test, 10.4% (82 students) partially completed it, and 69.1% (544 students) did not attempt it (see Fig. 1).
  - This may reflect the low perceived stakes of the test, but may also be associated with a low enrollment rate among the non-attempted cohort: 72% of students who were invited to complete PELA but did not attempt it ultimately did not enroll at the University.

FIG. 1: PELA Test Completion Rate (2020-2025)

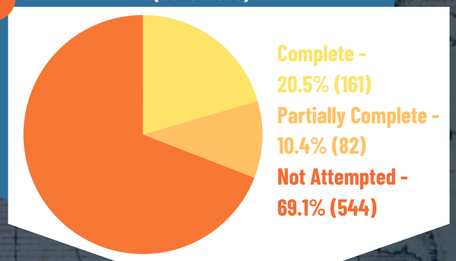
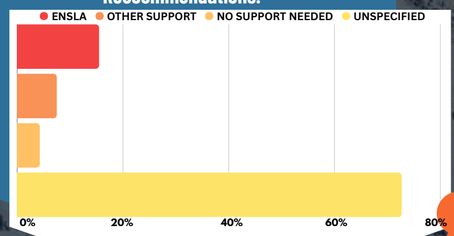
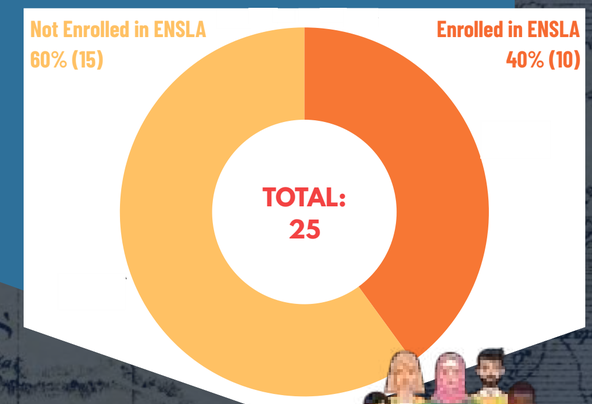


FIG. 2: Distribution of PELA Learning Support Reccommendations.



- Among the students who completed the PELA, a range of recommendation types were recorded: 15.5% (25 students) were recommended **ENSLA**, 7.5% (12 students) were advised to engage with **other learning support** such as conversation circles or student learning activities, 4.3% (7 students) were assessed as needing **no further support**, and 72.2% (117 students) received an **unspecified** recommendation (see Fig. 2).
  - The high number of "unspecified" recommendations suggests inconsistencies in how recommendations were recorded or communicated to students, and this requires further investigation.
- Of the students who were recommended to take ENSLA, 40% (10 out of 25) actually enrolled in an ENSLA coded paper (see Fig. 3).
  - **Low uptake** likely reflects the voluntary nature of support recommendations and negative perceptions of "requiring aid" like ENSLA.
- Students who followed the recommendation to enroll in ENSLA had a lower average GPA (4.9) than those who did not (6.7), suggesting a self-selection effect: academically vulnerable students were more likely to opt in. This indicates that **the existing voluntary support enrollment model may be effective** in engaging the intended most-at-risk students—although the missed potential benefits for students who did not enroll cannot be forgotten.

FIG. 3: Enrollment Rate in ENSLA Papers for Students Recommended for ENSLA.



CONCLUSION

Low uptake of the PELA assessment and limited follow-through on recommended support suggests that voluntary participation may constrain the assessment's effectiveness in identifying and assisting at-risk students. Making PELA compulsory could increase engagement, as Read and von Randow (2013) found that students generally respond positively when language diagnostics are required. However, GPA analysis indicates that the current voluntary support enrollment model effectively engages the most at-risk students, suggesting that support does not need to be compulsory to reach those who need it most Therefore, implementing a combined approach with **mandatory assessment and optional support pathways** is the most effective way forward for the University of Waikato as it maximises early identification while preserving the autonomy and positive engagement of voluntary support.

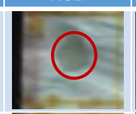
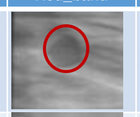
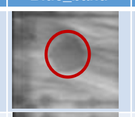
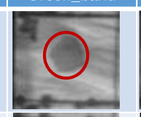
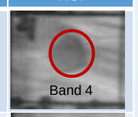
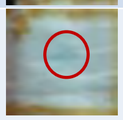
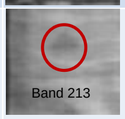
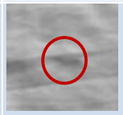
ACKNOWLEDGEMENTS

Research by: Mikyla Rowe,
Supervisors: Esra Yaghi, Chelsea Blickem

Revealing Invisible Forensic Evidence with Hyperspectral Imaging

Supervisor: AProf. Ye Chow Kuang
Student: MInfoTech Anna Savitskaia
Student ID: 1660694

Background and Motivation

Liquid	RGB	Red_band	Blue_band	Green_band	HSI
blood (Can we see it?)					 Band 4
Blood + saliva (Can we see it?)					 Band 213
milk+ sunscreen (Can we see it?)					 Band 217

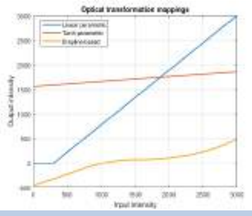
In forensic investigations, fast and accurate identification of fluids on found fabrics is crucial. It helps investigators quickly identify potential suspects or victims. But, traditional techniques struggle when working with complex fabrics (dark, patterned, or textured), because stains can blend into the background and become invisible. This makes the investigation slow and uncertain. Also most of them are destructive, meaning that the process of taking samples from the fabric destroys the evidence itself.
This motivates the use of non-destructive imaging-based testing methods, which allow investigators to preserve evidence while enhancing the visibility of otherwise hidden traces.
To address this, our project explores hyperspectral imaging (HSI), which captures hundreds of spectral channels, in our case, 224.
Why to use HSI instead of RGB? Because each liquid has unique chemical and spectral properties, and it may only be visible in a very specific wavelength. So while in normal RGB (has only three channels) images the evidence might be invisible, in HSI data, we can often find a band where the trace clearly appears.
Previous studies demonstrate the promise of hyperspectral imaging combined with machine learning for forensic fluid detection. They provide a strong foundation for this project while also revealing unresolved challenges related to weak spectral contrast and evaluation without labels [2][3].

Optical Transformation

An optical transformation is a process that modifies intensity values, increases contrast, suppresses noise, or highlights certain parts of an image. Two approaches to such transformations have been proposed:

- parametric (P) (1-2 parameters)
- spline-based (SB) (any number of parameters)

Since real forensic samples are rare and often confidential, our team created a controlled dataset, which consists of fabric pieces with artificially applied liquids (blood, milk, sunscreen, or tea).



Spline functions were demonstrated as an effective approach for image restoration, showing that splines can model smooth intensity variations while preserving important image structures [10][14].

In practice, we can observe a significant visual difference between the P and SB transformations, but SB did not yield a significant improvement in the quality of the results compared to P transformations

Percentage of recognised patches

With Splines			Without Splines		
Patch 1 (milk)	Patch 2 (skmilk)	Patch 3 (saliva)	Patch 1 (milk)	Patch 2 (skmilk)	Patch 3 (saliva)
24%	18%	2%	39%	33%	0%

Methods

The proposed pipeline consists of the following key components:

- Low-Rank Representation (LRR): The idea is that the background fabric has a predictable, repetitive spectral pattern – it is low-rank. The forensic trace is different – it is an anomaly that stands out in specific bands. LRR helps us to separate the trace from the background.
- Projection: It helps to reduce noise and dimensionality, keeping only the most important spectral information. HSIs are very high-dimensional, this step improves both accuracy and efficiency.
- Spectral Clustering: Builds a graph where pixels are connected to their nearest neighbours based on spectral features. Then analyses the connectivity structure of this graph, transforming the data into a new space where pixels that are strongly connected become close together. Finally, a clustering method is applied in this transformed space to identify distinct regions (clusters that are sharing same spectral behaviour – desired trace area).


Cluster is found

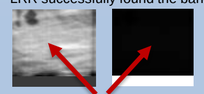

Cluster is not found


Uncertain result

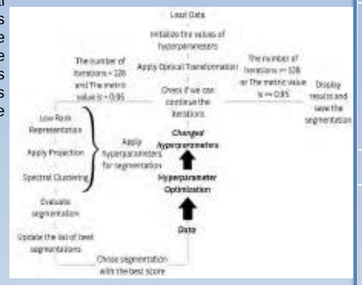
Our Data | **Baseline Result** | **Expected result**

Our data | **LRR result** | **Projection Result**

LRR successfully found the band



LRR wasn't successful

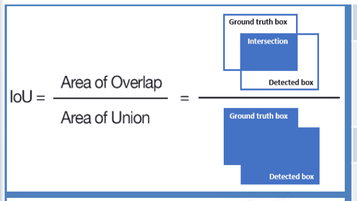


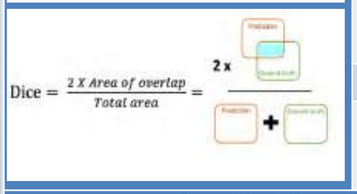
Main Loop

Unsupervised Evaluation Metrics

Since we don't have labelled data in our case, we were faced with the problem of how to tell the algorithm that the found cluster is the spot we were looking for.
Here are several metrics we proposed to use:

Intersect and Union (IOU)[1] and Dice Coefficient (DICE)[11]





Clusters doesn't intersect => no spot found

IoU = 0.000, Dice = 0.000

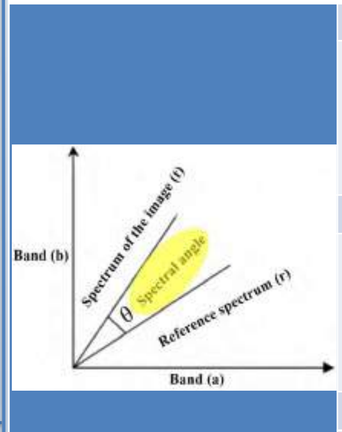
Poor intersection => poor quality of found spot

IoU = 0.180, Dice = 0.305

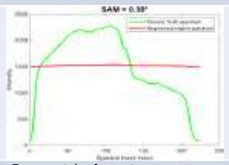
Almost complete intersection => good quality of found spot

IoU = 0.746, Dice = 0.855

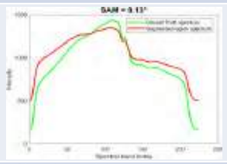
Spectral Angle Mapper (SAM)[6]



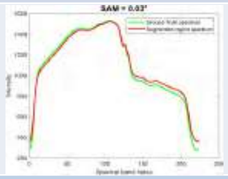
Spectrums doesn't match => no spot found



Poor match of spectrums => poor quality of spot



Almost complete match => good quality of found spot



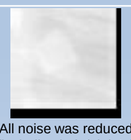
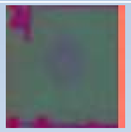
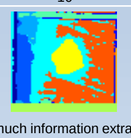
After applying different metric for evaluation, we can conclude that applying SAM takes significantly more time that other two, but in visual evaluation SAM produces the worst results, so we can make a conclusion that using spectral information isn't useful for us. There is no significant difference between IoU and Dice. So, we decided to continue using the IoU.

Percentage of recognised patches

IoU		Dice		SAM	
Baseline	Bandit	Baseline	Bandit	Baseline	Bandit
40.83%	67.5%	55%	71.67%	0%	1.67%

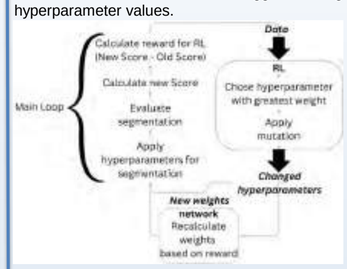
Hyperparameter Sensitivity and the Need for Optimisation

The performance of LRR, projection, and spectral clustering depends critically on their hyperparameters. Poorly chosen values can result in excessive noise, loss of important spectral information, or trivial segmentations (they identifies a spot of a liquid. We will provide several examples of hyperparameters we are using to demonstrate how they affect our results.

Optical transformation coefficient	Projection coefficient	Maximum number of clusters
Optical transformation coefficient = -1	Projection coefficient = -10	Maximum number of clusters = 1
 High intensity (brighter image)	 All noise was reduced (including helpful data)	 The whole image is considered as one cluster (no useful information extracted)
Optical transformation coefficient = 1	Projection coefficient = 0	Maximum number of clusters = 10
 Low intensity (darker image)	 Almost all the data is kept (no noise reduction)	 Too much information extracted, some of it is noise

Reinforcement Learning for Hyperparameter Search (RL)

Standard evolutionary algorithms are a natural candidate for hyperparameter optimisation, but their high computational complexity makes them too slow for high-dimensional HIS data.
One of the studies we found suggests using reinforcement learning to find optimal hyperparameter values.



The essence of this approach is as follows: the model agent selects hyperparameter combinations, evaluates the result of applying the new combination, and learns to propose combinations that improve this result [7].
This approach shows poor performance compared to the other approaches. Also, this method is significantly slower than the others. So, it shows that simplified algorithms show better performance than complicated ones.

Baseline Method (baseline)

This approach is an example of a classic evolutionary approach for hyperparameter optimization.
The main idea is to change the hyperparameters of the best segmentations trying to improve the score, but with some probability also trying to find better combination of hyperparameters for the weakest segmentation.

The key lies in how we select this hyperparameter; in this particular approach, the probability of selecting any one of the hyperparameters from the entire set is the same for all. This approach works quite well; the metric values are not particularly high, but a visual assessment of the recognition results suggests that it performs quite well.

Bandit-based Optimization / Hyperband (Bandit)

One study also suggests using a multi-armed bandit for a similar task. This approach is more efficient in terms of computational and time costs. It tries to focus on combinations that provide the greatest improvement in the result, and in each new iteration, it will favour the most promising candidates.

Its operation is very similar to reinforcement learning, but it does not use neural networks internally to train weights and is a simplified version of the previous approach [9].
This approach also performs quite well; the metric values are not particularly high, but a visual inspection of the recognition results suggests that it performs quite well. However, it does not significantly outperform the baseline approach.

Bayesian optimization (BO)

Bayesian optimization is considered an effective method for finding optimal hyperparameters.

Its essence is that we assume that the output of our algorithm depends on our set of hyperparameters, and this dependence is the unknown function we're trying to find [12].
This approach is significantly slower than all the previous ones, as it changes all values, but it also shows significant improvement in metrics compared to all previous methods, even better than baseline. As for visual inspection this method shows average degree of recognition.

Classifier

Recently, research has increasingly recognized the importance of human-assisted approaches for guiding machine learning systems in scenarios where fully automated evaluation is unreliable or poorly correlates with human perception [4][5][8][13].
This approach allows us to significantly speed up the algorithm and remember which sets of hyperparameters produce good results for which images.

After implementing this approach, we were able to improve the results for some instances of our dataset, but when trying to provide it with new data, it does not always give a satisfactory result, which demonstrates that the developed approach does not yet handle new data well and is prone to overfitting.

Results

We ran 10 experiments for each of these approaches with different number of used hyperparameters on patch 18 (milk + black tea) and we got the following results:

Method+Number of parameters	Average time (minutes)	Average metric (IoU)	% of recognised patches
BO+17	830	0.81	0%
2-layer RL+4	570	0.66	1%
1-layer RL+4	485	0.63	0%
Bandit+17	290	0.60	1%
Bandit+4	300	0.66	0%
Baseline+17	247	0.63	1%

For patch 4 (blood)we got the following results

Method+Number of parameters	Average time (minutes)	Average metric (IoU)	% of recognised patches
BO+17	152	0.72	52%
BO+4	148	0.72	24%
2-layer RL+17	48	0.5	23%
2-layer RL+4	187	0.6	62%
1-layer RL+17	427	0.61	52%
1-layer RL+4	404	0.64	58%
Bandit+17	113	0.63	84%
Bandit+4	46	0.62	80%
Baseline+17	115	0.62	82%
Baseline+4	39	0.63	63%

We used for experiments the dataset of household liquids captured with a camera operating in the 400-750 nm wavelength range and also the same dataset captured with near-infrared camera operating in the 800-1000 nm wavelength and a forensic dataset captured with near-infrared camera.

Patch with blood

Domestic dataset NIR | Domestic dataset VIS | Forensic dataset NIR

Conclusions

- LRR can successfully identify spectral channels containing useful information about spot location, but not for all liquids.
- Successful results depends heavily on a well-chosen set of hyperparameter values; incorrectly chosen values can produce completely uninformative results.
- Spot locations for some liquids are very easy to find, even with random hyperparameter values. Blood is an example of such liquids. This is due to the chemical properties of liquids.
- Some liquids, however, are impossible to detect by any hyperparameter optimization approach. Example of such liquids include tea. One of the reasons for this is that their spectral values differ only slightly from the spectral values of the tissue background.
- Another reason for this is that their spectral values were not captured by the camera used during filming, and all the channels we use simply do not contain the spectral information we are looking for.
- By combining two datasets created using two different cameras, we can recognize almost all liquids. Therefore, expanding the spectral range used can help us recognize liquid traces.
- However, the quality of the dataset preparation is also critically important for us, because regardless of the camera used, the preprocessing approach, or the hyperparameter optimization method, we can obtain unsatisfactory results if there were inaccuracies in the dataset preparation, crease formation in the fabric, overlapping of fabrics with shifts when rotating, or other human factors.
- Using overly complex approaches to hyperparameter optimization is not optimal for us; they do not provide improvements in the results and take significantly longer to execute. We should focus on simplified approaches that utilize ideas from reinforcement learning and evolutionary approaches, but do not require training neural networks.
- Using more parameters for optical transformations (splines) does not provide a significant improvement in liquid trace recognition, but it does slow down the algorithm's execution, as we need to learn the values of more hyperparameters.
- Introducing a human into the loop can help correctly evaluate results and provide the algorithm with additional information about the data. However, caution is needed, as such an introduction can lead to overfitting, resulting in the algorithm achieving 100% accuracy on known data, but producing unsatisfactory results when tested on new data.

Acknowledgements

I would like to express my sincere gratitude to my supervisor, AProf. Ye Chow Kuang, for his continuous guidance, patience, and insightful feedback throughout this research. I am also thankful to the Prof. Melanie Ooi for her valuable suggestions and encouragement.
Thanks for all members of WAI2M team of University of Waikato's School of Engineering for their support, suggestions and encouragement.

References

1. Bowen Cheng, Ross Girshick, Piotr Dollar, Alexander C. Berg, Alexander Kirillov; Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR), 2021, pp. 15334-15342.
2. Faisal, S., Ooi, M. P. L., Kuang, Y. C., Thawdar, Y., Abeysekera, S., Reutemann, P., ... & McClelland, H. (2025, May). Identifying Biological Fluids using Hyperspectral Near-infrared Imaging and Machine Learning for Forensics Analysis. In 2025 IEEE International Instrumentation and Measurement Technology Conference (I2MTC) (pp. 1-6). IEEE.
3. Faisal, S., Ooi, M. P. L., Kuang, Y. C., Abeysekera, S. K., & Fletcher, D. (2025). An overview of integrating deep learning methods with close-range hyperspectral imaging for agriculture. IEEE Access.
4. Friebel, A., Johann, T., Drasdo, D., & Hoehme, S. (2022). Guided interactive image segmentation using machine learning and color-based image set clustering. Bioinformatics, 38(19), 4622-4628.
5. Guillot Suarez, C. (2022). Human-in-the-loop hyperparameter tuning of deep nets to improve explainability of classifications.
6. J. E. Ball, L. M. Bruce, T. West, and S. Prasad, "Level set hyperspectral image segmentation using spectral information divergence-based best band selection," 2007 IEEE International Geoscience and Remote Sensing Symposium, Barcelona, Spain, 2007, pp. 4053-4056, doi: 10.1109/IGARSS.2007.4423739.
7. Jomaa, H. S., Grabocka, J., & Schmidt-Thieme, L. (2019). Hyp-rl: Hyperparameter optimization by reinforcement learning. arXiv preprint arXiv:1906.11527.
8. Kist, A. M., Razi, S., Groh, R., Gritsch, F., & Schützenberger, A. (2025). Predicting semantic segmentation quality in laryngeal endoscopy images. PloS one, 20(7), e0314573.
9. Li, L., Jamieson, K., DeSalvo, G., Rostamizadeh, A., & Talwalkar, A. (2018). Hyperband: A novel bandit-based approach to hyperparameter optimization. Journal of Machine Learning Research, 18(185), 1-52.
10. Peyrovian, M. J., & Sawchuk, A. A. (1978). Image restoration by spline functions. Applied Optics, 17(4), 660-666.
11. Shamir, R. R., Duchin, Y., Kim, J., Sapiro, G., & Harel, N. (2019). Continuous Dice coefficient: A Method for Evaluating Probabilistic Segmentations. ArXiv. https://arxiv.org/abs/1906.11031
12. Wu, J., Chen, X. Y., Zhang, H., Xiong, L. D., Lei, H., & Deng, S. H. (2019). Hyperparameter optimization for machine learning models based on Bayesian optimization. Journal of Electronic Science and Technology, 17(1), 26-40.
13. Wu, X., Xiao, L., Sun, Y., Zhang, J., Ma, T., & He, L. (2022). A survey of human-in-the-loop for machine learning. Future Generation Computer Systems, 135, 364-381.
14. Xie, Z., & Farin, G. E. (2004). Image registration using hierarchical B-splines. IEEE Transactions on visualization and computer graphics, 10(1), 85-94.

TAURANGA MOANA SPEAKS

He kohinga kōrero nā ētahi kaumātua nō Tauranga Moana, mō Tauranga Moana, mā ngā uri o Tauranga Moana.

Prepared by: Kahiwa Sebire (*Ngāti Tukorehe, Ngāti Raukawa ki te Tonga, Ngāti Porou, Te Whānau-ā-Apanui*)
Supervisor: Ahonuku - Associate Professor Ngairo Eruera, Te Pua Wānanga ki te Ao - Faculty of Māori and Indigenous Studies (*Ngāti Ranginui, Ngāti Awa, Ngāi Tūhoe*)

Special thanks to:
- René Swan, Team Leader: Heritage & Research; and Amie Rolleston, Mātanga Taonga Tuku Iho Māori, Tauranga City Council
- Summer Research Program, Te Whare Wānanga o Waikato

He kōrero whakataki

E mihi atu nei i runga i te whakamoemiti ki te tangata whenua o te takiwā nei o Tauranga Moana: ki ōna iwi ki a Ngāti Ranginui, ki a Ngāi Te Rangi, ki a Ngāti Pūkenga; ā, ki te hapū o Ngāi Tamarāwaho, tēnei ka mihi ki ngā kaitiaki o tēnei wāhi ā Tauranga moana, ā Tauranga tangata.

I aro tēnei kaupapa ki ngā kōrero o ngā tāngata nō te rohe o Tauranga Moana. Inarā, ō rātou whakaaro e pā ana ki ngā tāhū pēnei i te tuakiritanga, i te panonitanga, i te tūmautanga o te whenua, o ngā tikanga, o te reo, o te tangata.

Kia noho tapu ēnei kōrero, tiakina ai, mā ngā kaupapa o te anamata e hāngai ana ki te rangahau, ki te whakaako, ki ngā whāinga o te hāpori hoki.

Ngā tukanga rangahau

As an oral history[1] project, participants' contributions were recorded[2], transcripts annotated with high-level topics.

This project was grounded in Kaupapa Māori[3] research principles, including kaupapa tuku iho[4]: Te reo Māori, Pūtaketanga, Whanaungatanga, Ūkaipōtanga, Whakapapa, Manaakitanga, Rangatiratanga

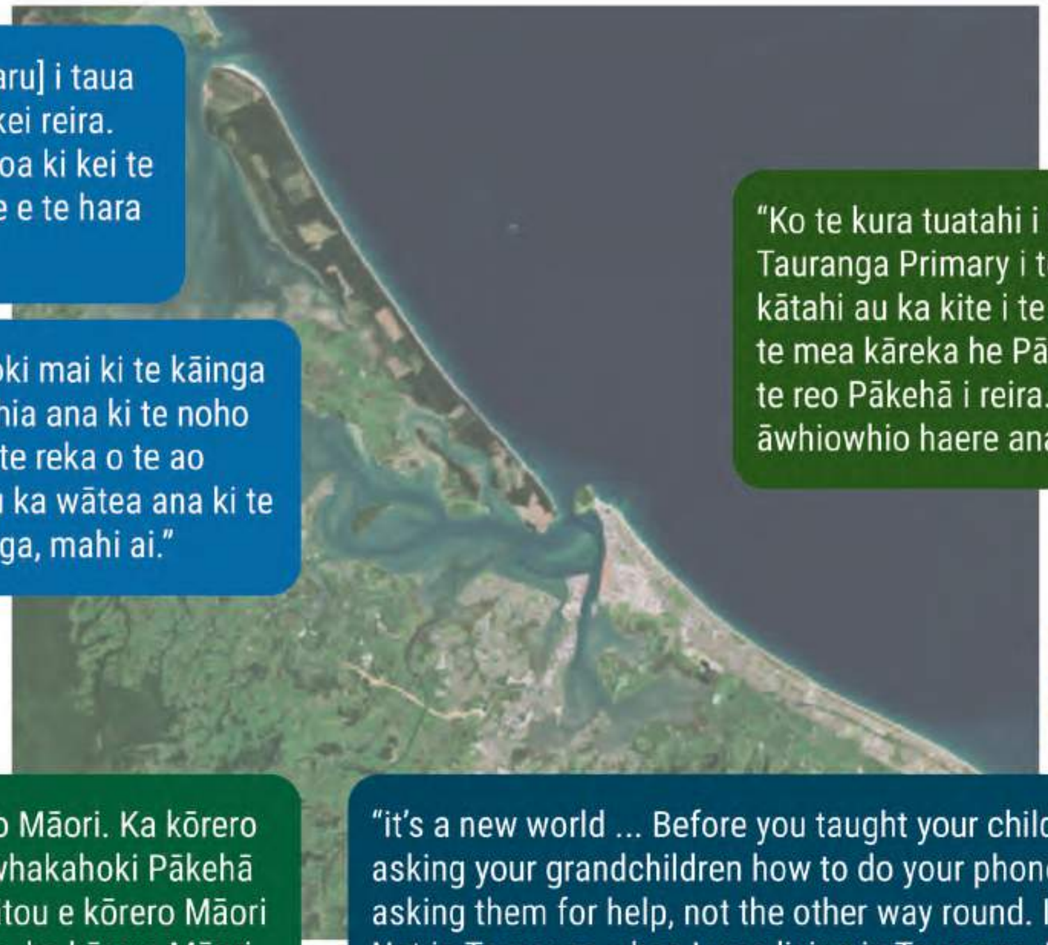
E 5 ngā tāhū o ngā uiuinga. I noho ngā tāhū, ngā pātai hoki, hei urungi:

- Te ao kōhungahunga me te whānau
- Ngā wāhi me te taiao
- Tikanga me te reo
- Mātauranga me te ao hapori
- Ngā panonitanga o te wā

TAURANGA MOANA

"Ka haere koe [ki te eke ngaru] i taua wā ki Arataki, Māori katoa kei reira. Nā rātou te pango kē te katoa ki kei te moana. Ka pōhehē he pioke e te hara mai, he tohorā rānei."

"Puta mai 17 ngā tau, ka hoki mai ki te kāinga [i te kura] ... Kāore au e hiahia ana ki te noho ki Motuhoa, kua rongo au i te reka o te ao whānui. So kei te oma ahau ka wātea ana ki te oma. So ka haere ki Tauranga, mahi ai."



TAURANGA TANGATA

"Ko te kura tuatahi i haere atu au ko Tauranga Primary i te tāone nei. Nā, kātahi au ka kite i te maha o te Pākehā, i te mea kāreka he Pākehā i Mōtītī. Kāore te reo Pākehā i reira. Ko te reo Māori e āwhiowhio haere ana i ngā wā katoa."

TAURANGA HERENGA WAKA

"Ka patua hoki mō te kōrero Māori. Ka kōrero Māori mai ngā pakeke, ka whakahoki Pākehā atu ki a rāua ... Engari ko rātou e kōrero Māori ana ki a rāua i ngā wā katoa, ka kōrero Māori mai ki a mātou."

NGĀ TAI-TIMU, NGĀ TAI-PARI

"it's a new world ... Before you taught your children. Now, you're asking your grandchildren how to do your phones and that. You're asking them for help, not the other way round. If I didn't go to Senior Net in Tauranga when I was living in Tauranga, I would be lost too. I wouldn't know how to journey through this time."

He kōrero whakakapi

Nōku te waimarie ki te noho tahi ki ētahi kaumātua o tēnei rohe, whakarongo ai, kohikohi ai i ngā kōrero hei kai mā tātou, mā ngā mokopuna ki te pae tawhiti.

It is a privilege to witness and listen to stories of our elders. Their knowledge is a gift that we are fortunate to be able to receive. My kete of qualitative research approaches now includes experience about oral history techniques. As a student of te reo Māori, this project gave me the opportunity to sit and immerse myself in te reo Māori stories.

Nā reira, ki ngā kaitautoko o te kaupapa nei, ki Te Whare Wānanga o Waikato, ki te Kaunihera o Tauranga Moana, ki a Ngairo Eruera, otirā ki ngā manu tīoriori, ki ngā kaumātua, tēnā koutou, tēnā koutou, tēnā koutou.

References

1. McRae, Jane. (2017). *MāoriOral Tradition : He Korero No Te Ao Tawhito*. Auckland University Press
2. Clayworth, P. (2010). *Recording Tangata Whenua Oral Histories and Traditions: Techniques and lessons from the Ruapekapeka Pā Oral History Project*. Department of Conservation Technical Services, 36. DoC: Wellington.
3. Smith, L. T. (2021). Towards Developing Indigenous Methodologies: Kaupapa Māori Research. In Decolonizing Methodologies. Bloomsbury Academic & Professional.
4. Winiata, R. (2022). *Proposing a Kaupapa Tuku Iho informed Māori model for practice to enhance cultural competence and foster kaimahi flourishing within health and social service providers*. The University of Waikato

Catching Brain Waves

EEG Signal Acquisition and Noise Reduction: An OpenBCI Case Study

Student: Craig Shepherd

Supervisors: Dr Mitchell Head, Dr Mahonri Owen

Introduction

Electroencephalography (EEG) records low-voltage electrical activity from the brain. EEG can be used to identify brain states such as concentration, relaxation, and flow.

Signal quality is dependent on acquisition conditions and noise mitigation strategies.

Aim

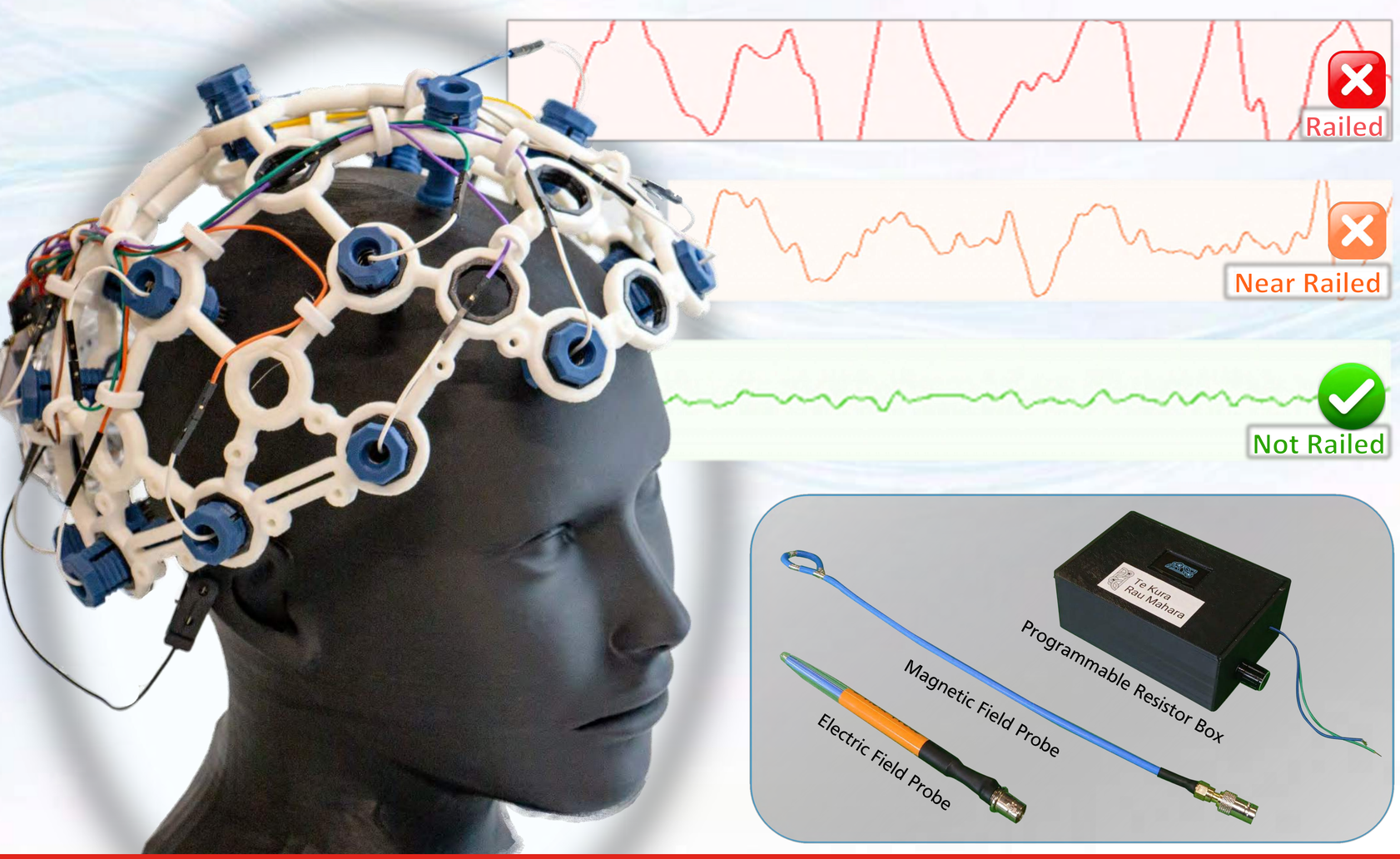
The aim of this project was to identify key noise sources in EEG acquisition and evaluate practical methods to improve signal reliability and quality in the context of a driving simulator. The data were synchronised with other key metrics such as telemetry, and event markers.

Method

A simulator at the Waikato Esports arena was used.

Electrode impedance was measured before and after recording sessions to assess contact quality and stability.

Railed channel detection was used to identify signal saturation and poor electrode contact.
Common noise sources were examined and mitigated.



Results

Improved electrode preparation and grounding reduced channel rail events.
Mitigation of noise sources included reducing participant movement, and increasing distance from the headset to other people.

Tools were developed to assist in finding electrical noise and validate the headset's measurements.

Switching off nearby electrical devices often reduced a 25 Hz power-line interference signal.

Conclusion & Future Work

Careful attention to EEG acquisition significantly improves signal and data quality. The results show that reducing electrical noise is essential for collecting clear and reliable EEG signals.

This work was used for pilot study data collection and informs protocols for future large scale participant research.

Waikato Esports
ROYAL SOCIETY TE APĀRANGI
Te Kura Rau Mahara
THE UNIVERSITY OF WAIKATO
Te Whare Wānanga o Waikato
MINISTRY OF BUSINESS, INNOVATION & EMPLOYMENT
HĪKINA WHAKATUTUKI

Making multivariable calculus easier with 3D printing

Research by Onyu Shin **Supervisors:** Dr. Ben Chang & Dr. Hin Lim. **Acknowledgements:** Dr. Woei Chet Lim & Duncan Bernard

Introduction

Learning multivariable calculus requires **strong spatial reasoning** to understand the physical meaning behind the equations. However, the conventional 2D teaching approaches often only provide limited 3D visualisation and lack interactivity. What if there was a way to help bridge that gap between the maths and their physical meaning?

Aim

Design and 3D print mathematical models as an interactive supplementary teaching tool and produce tutorial videos to evaluate its effectiveness on the students enrolled in ENGEN201-26H course.

Methodology

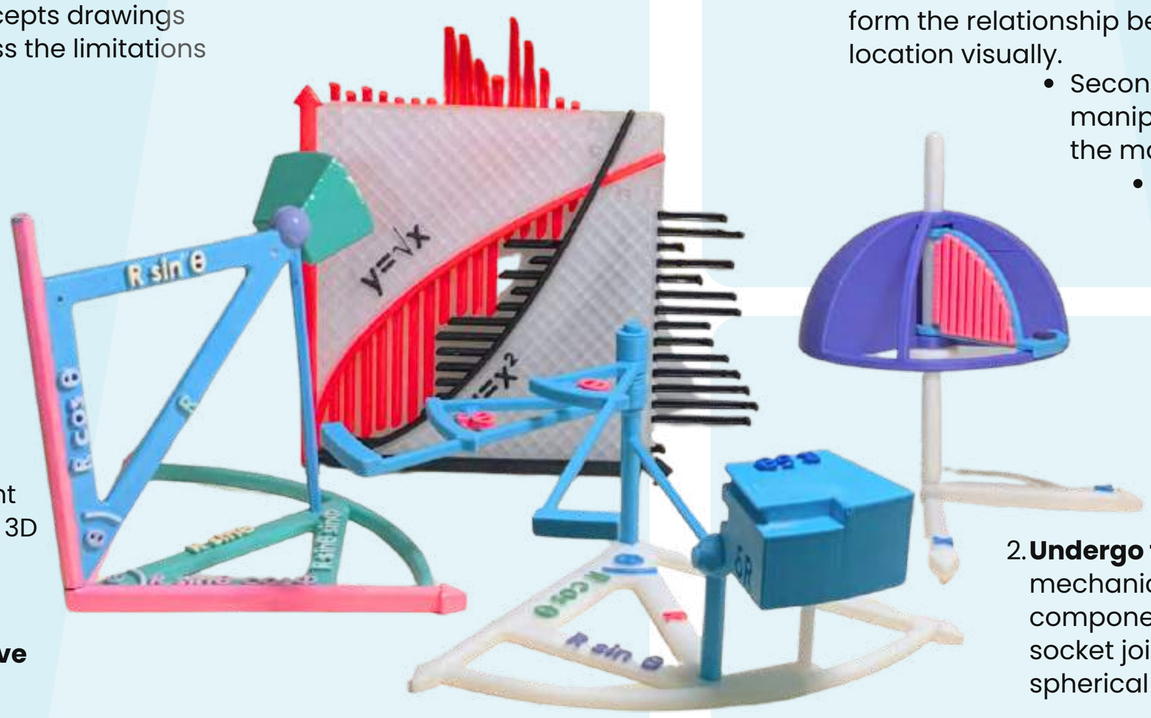
01 **Research & Ideation.** Produce concepts drawings that target specific areas to address the limitations from 2D representation.

02 **Design on SolidWorks.** SolidWorks parts and assembly created.

03 **Prototype & Iterate design.** Slice on PrusaSlicer to convert the STL file into a 3D printable G-code to test material strength, tolerances, size, and make iterations to the design.

04 **3D print & post-processing.** 3D print using Adventurer 5M Pro and Prusa 3D printers.

05 **Use in tutorial & Conduct qualitative analysis.**



Results

- Annotations on the 3D-printed models serve to bridge the gap between the coordinate transformation formulas and their spatial location.
- Mechanical components allows for physical manipulation to mirror each step of the calculus, relating the maths to their meaning.
- Detatchable 2D segments helped to demonstrate that a 3D volume is a summation of infinite 2D slices and to show the physical meaning of the orders of integration.

Discussion

Three versions of the tutorial videos utilise the 3D models to support students at varying levels of understanding, serving to transition from basic to advanced level of understanding of the concept.

- First video used the 3D models as a static model, pointing to specific parts to form the relationship between the mathematical variables and spatial location visually.
  - Second video involved physical interaction with the model by manipulating the moving components to simulate the steps in the maths.
    - The final video will focused purely on the conveying the concept, utilising the 3D model to explain the concept at a high level.

Future work

1. **Conduct qualitative survey** on students to gain feedback on the effect of their learning experience of the concept- visualisation, understanding and engagement.
2. **Undergo further design iterations.** Reflecting on tutorials, mechanical components proved effective. Designing detatchable components to create a close up view, and integrating ball and socket joints to accurately represent the degrees of freedom in spherical coordiantes.

Exploring footwear policies in NZ schools

THE UNIVERSITY OF WAIKATO
Te Whare Wānanga o Waikato
QS WORLD UNIVERSITY RANKINGS
TOP 235 IN THE WORLD 2025
#1 IN RESEARCH IN NEW ZEALAND 2025

Introduction

Many schools in New Zealand have policies regulating footwear. The shoes children wear can affect how their feet develop, with bare feet supporting natural growth.

In the absence of **standardised guidelines to inform schools' footwear policies**, it is unclear what schools are recommending.

Aim

To collate footwear policies from Bay of Plenty and Waikato schools and consider socioeconomic and geographical factors.

Methods

Databases containing website addresses and contact details of New Zealand schools were obtained from www.educationcounts.govt.nz.

Publicly available school websites were screened for regulations placed on footwear and whether bare feet were allowed. When not found online, schools were emailed and then phoned.

Socioeconomic and geographic factors (region, school type, equity index (EQI), and rurality) were also sourced from the databases.

Chi-Square and Fisher's exact tests were used to compare the frequency of regulations and bare feet allowance between schools.

Results

210 policies (**112** Bay of Plenty, **98** Waikato) were obtained from 290 schools. Footwear policies were comparable between regions.

Primary schools had less footwear regulations and allowed bare feet more often than intermediate, secondary and composite ($p < 0.05$).

Footwear regulations were less prevalent in schools within the more or moderate EQI brackets, as well as in rural schools ($p < 0.05$).

Footwear Regulations

Counts (Percentages)

Region	Yes	No
Bay of Plenty	41 (41%)	58 (59%)
Waikato	33 (43%)	44 (57%)
Chi-Square p = 1.00		

School Type	Yes	No
Primary*	27 (24%)	88 (76%)
Intermediate	11 (100%)	0 (0%)
Secondary	29 (83%)	6 (17%)
Composite	7 (64%)	4 (36%)
Fisher's p = <0.01		

EQI Bracket	Yes	No
494-569 (More)	24 (35%)	44 (65%)
419-494 (Mod)	32 (39%)	50 (61%)
344-419 (Fewer)*	16 (67%)	8 (33%)
Chi-Square p = 0.02		

Rurality	Yes	No
Urban	68 (51%)	64 (49%)
Rural	6 (14%)	38 (86%)
Chi-Square p = <0.01		

Bare Feet Allowed

Counts (Percentages)

Region	Yes	No
Bay of Plenty	41 (41%)	60 (59%)
Waikato	28 (30%)	66 (70%)
Chi-Square p = 0.15		

School Type	Yes	No
Primary*	62 (48%)	66 (52%)
Intermediate	0 (0%)	11 (100%)
Secondary	2 (5%)	37 (95%)
Composite	1 (9%)	10 (91%)
Fisher's p = <0.01		

EQI Bracket	Yes	No
494-569 (More)	29 (43%)	39 (57%)
419-494 (Mod)	35(40%)	53 (60%)
344-419 (Fewer)*	5 (14%)	30 (86%)
Chi-Square p = 0.01		

Rurality	Yes	No
Urban	44 (29%)	110 (71%)
Rural	25 (61%)	16 (39%)
Chi-Square p = <0.01		

Discussion

Footwear regulations increase as children in New Zealand progress through schooling. Higher barefoot allowance in primary schools is perceived as beneficial for supporting natural foot development.

Schools in the more-moderate brackets or in rural areas may have fewer footwear regulations to avoid burdening their communities with costs associated with footwear.

Many policies were unavailable or required extensive contact, restricting information that could be beneficial for prospective students.

What Next?

Increasing sample size and continuing to add to the database of policies will increase confidence in the findings and cover a wider range of socioeconomic and geographic factors.

The creation of a policy database will hopefully facilitate the establishment of standardised guidelines for footwear policies in schools.

Design: Tom Sims
Supervisors: Kim Hebert-Losier, Victoria Egli

FROM CHAOS TO CLARITY: AN LLM-EMPOWERED FRAMEWORK FOR ANALYZING CYBER ATTACKS IN HONEYPOT LOGS

1.INTRODUCTION

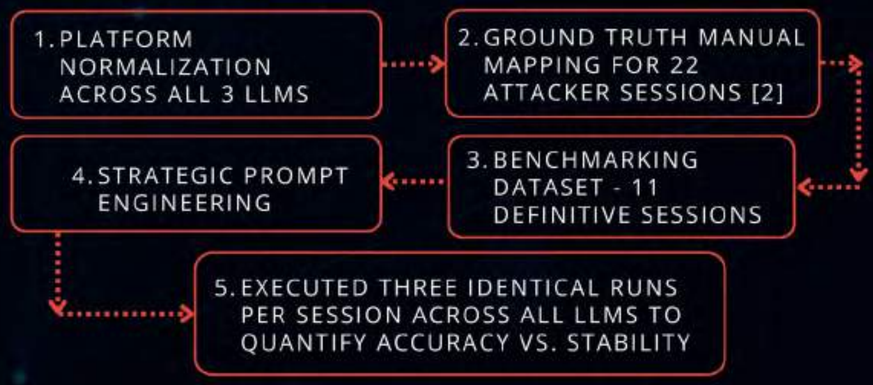
Modern cybersecurity environments face a growing volume of cyber attacks, where detection alone is insufficient. Analysts must reconstruct attacker intent and accurately identify Tactics, Techniques, and Procedures (TTPs).

Honeypots such as Cowrie capture real attacker behaviour through shell commands, but these logs are noisy, complex, and difficult to analyse at scale. Manual MITRE ATT&CK mapping is accurate but not scalable.

This study addresses limitations in prior LLM-based approaches by introducing expert-validated ground truth for MITRE ATT&CK mapping.

Prior Research by Haito Wang [1]	Identified Gap
• Proposed an LLM-assisted framework to convert raw logs into structured attack stories and MITRE ATT&CK mappings. • Integrated the SMET2 classifier to suggest techniques and extracted IoCs from external threat sources. • Developed interactive attack-flow visualizations for multi-stage threats.	• No Human Ground Truth: Original evaluations relied on model agreement rather than human-validated metrics. • Prompt Anchoring: Models often followed classifier suggestions blindly, even when incorrect. • Honeypot Complexity: High bot noise and short, "naked" commands (e.g., ls, cd) lack the context required for stable AI reasoning.

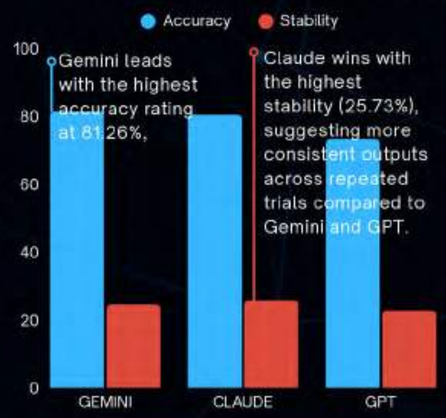
2.METHODOLOGY



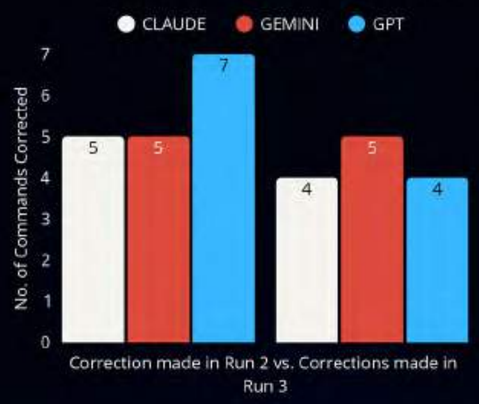
3.RESULTS/FINDINGS

- Accuracy is the percentage of correctly predicted MITRE ATT&CK techniques as measured against the expert-validated human ground truth.
- Stability refers to the consistency of a model's predictions across multiple identical runs, indicating its ability to produce the same results without variance.

Fig 1. Accuracy vs. Stability (%)



- Despite using deterministic settings (Temperature = 0), stability analysis identified 30 "corrections" where models changed their answers in subsequent runs, indicating inherent randomness in model behavior.

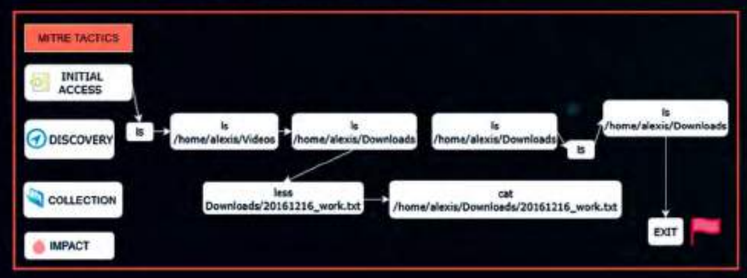


- Higher session complexity, measured by the number of unique tactics, directly correlates with increased error rates across all evaluated models. Short, generic commands increase these inaccuracies by lacking the rich context required for stable and precise MITRE ATT&CK mapping

Fig 2. Complexity vs. Error Rate (%)

SCAN FOR MORE DETAILS

ATTACK FLOW GRAPH GENERATED FOR A SESSION



4.CONCLUSION

- LLMs show strong potential for automating attacker session analysis, but reliability varies by model, prompt design, and context.
- Human-validated ground truth exposes clear differences in accuracy and stability across GPT, Gemini, and Claude.
- Model agreement alone is insufficient; expert judgment is essential for trustworthy MITRE ATT&CK mapping.
- Human-in-the-loop validation remains critical for operationally reliable, AI-driven cyber threat intelligence.

5.NEXT STEPS

- Expand the ground-truth dataset by adding the remaining 11 expert-evaluated attacker sessions with full attack stories and MITRE ATT&CK mappings.
- Improve confidence alignment between LLM outputs and ML classifiers such as SMET2.
- Explore hybrid architectures that combine LLM reasoning with rule-based and statistical safeguards to reduce hallucinations.
- Create and share a structured, human-derived reference dataset to better align automated mappings with expert judgment for real-world SOC use.

POSTER BY- AKANSHA SINGH
SUPERVISORS - DR. JUNAID HASEEB, DR. VIMAL KUMAR

ACKNOWLEDGEMENTS - UNIVERSITY OF WAIKATO SUMMER RESEARCH PROGRAM

REFERENCES-

[1] Haito Wang: LLM-assisted Attack Analysis and Visualization for Cowrie Honeypots

[2] Timothy Barron and Nick Nikiforakis. Picky attackers: Quantifying the role of system properties on intruder behavior. In Proceedings of the 33rd Annual Computer Security Applications Conference, page 387–398, Orlando FL USA, December 2017. ACM.

Is It Safe to Manu?

Real-time Environmental Safety Monitoring for Community Jump Sites

By Blake Smith, Supervised by Dr Jessica Turner and Dave Parsons

Introduction

Situated in the heart of the Tauranga CBD, The Strand functions as a key recreational area and community swimming spot. The site is known for variable water quality and strong tidal currents, especially after heavy rainfall carrying urban runoff. The Manu Meter is a proof-of-concept digital system designed to assess conditions and make a recommendation regarding the safety for swimming and jumping. To be displayed on a digital totem at the Wharf, this project has been developed in conjunction with Tauranga City Council. This system aims to provide an at-a-glance recommendation to encourage swimmer safety.

Method

The Manu Meter combines real-time environmental data with lab tested water quality samples. This data is then fed into a risk assessment matrix, where its assessed to produce a safety recommendation. The recommendation is displayed using a simple traffic-light system: green, “Good to Manu”; yellow, “Swim with discretion”; and red, “Do not swim”.

Data Sources

- Tide Height (Regional Council)
- Water Quality (Regional Council)
- UV Index (NIWA)
- Wind Speed (MetService)
- Water Temp (Regional Council)

My Experience

The Summer Research programme has provided me with invaluable experience, from working within the Tauranga City Council to understanding the inner workings of a large-scale organisation. This project offered a firsthand look at the realities of the research process moving from a conceptual design to a functional digital tool.

One of the largest challenges for me was the design aspect. Through this challenge, I developed a greater appreciation for the importance of clear communication, usability, and working within real-world constraints when designing a public-facing system.

Acknowledgements: University of Waikato School of Computing • Tauranga City Council • BOP Regional Council • Summer Research Programme 2025/26

From Risk to Resilience: Te Tiriti-Based Partnerships in Climate Adaptation Governance

Thea Smith, Professor Silvia Serrao-Neumann, Sarah Bassett, Dr Akuhata Bailey-Winiata

Acknowledgements to the TCC Takewaenga Team

Introduction

This project explores climate change adaptation planning led by iwi/hapū within Tauranga Moana to identify barriers they face in the adaptation planning process and make recommendations based upon them. The findings will inform the integration of Te Tiriti-based partnerships into Tauranga City Council's Climate Change Risk Assessment.

Stage 1: TCC Adaptation Stocktake

Most climate adaptation planning done by hapū in Tauranga Moana appears within iwi/hapū management plans or council risk reports, many of which were developed before climate risk was a central focus. There was not enough data available to make accurate recommendations, so the project moved onto stage 2.

Stage 2: National Stocktake Findings

Across iwi and hapū climate adaptation planning, the most significant **barriers to adaptation** were:

- 📊 Local data gaps
- 🧠 Capacity constraints
- 💰 Funding barriers
- 🙏 Governance misalignment
- 🧭 Limited Māori inclusion
- 🌱 Mātauranga integration

Stage 3: Bringing it back home - TCC hapū survey

A climate change adaptation survey was sent out to iwi and hapū representatives

The survey results reaffirmed the barriers the research in stage 2 highlighted

Recommendations

Establish a partnership model and an expert support network

- Resource roles or programmes that assist hapū with project design, coordination, funding applications, and implementation
- Information sharing and resource efficiency
- Reduces consultation/engagement fatigue
- Funding opportunities

Educational Wānanga series:

- Co-develop iwi/hapū climate action pathways e.g. DAPP planning
- Wānanga-led processes to develop pathways alongside iwi and hapū.

Resource Booklet

To promote and streamline accessibility to climate change education at whanau, marae, and hapū levels:

*At the time of the posters due date the booklet is still in draft version

References:
Iornes, C.J. (2019). *Treaty of Waitangi duties relevant to adaptation to coastal hazards from sea-level rise*. https://deepsouthchallenge.co.nz/wp-content/uploads/2020/12/Treaty-of-Waitangi-duties-relevant-to-adaptation-to-coastal-hazards-from-sea-level-rise.pdf.
Mackintosh, R. L. (2025). *A Climate Change Adaptation Model for Māori Groups, Aotearoa, New Zealand*. https://www.tekaharoa.com/index.php/tekaharoa/article/view/483/389
Tauranga City Council. (2023). *Tauranga Climate Action & Investment Plan 2023–2033.* https://www.tauranga.govt.nz/Portals/0/data/council/strategies/files/tauranga-climate-aip.pdf

Whanake ake: Kōrero tuku iho o ngā marae

Ariana Stewart
Supervisor: Tom Roa

Background

While Maniapoto history is often discussed at iwi (tribal) and rohe (regional) levels, the language and kōrero (stories) of individual marae are frequently underdocumented, fragmented, or held within restricted archives. When these stories are inaccessible, so too is te reo Māori (the Māori language) and mātauranga Māori (Māori knowledge systems) that anchor identity at the marae level.

For this reason, this project brings together kaupapa Māori approaches and Western research tools to preserve and re-centre marae-specific kōrero. By working across archives and kōrero tuku iho (intergenerational narratives) with kaumātua (elders), the project gathers both recorded and living language, ensuring these histories remain spoken, understood, and passed on.

Conclusion

As more Maniapoto descendants live away from their marae, the need to carry knowledge across distance becomes increasingly important. Without conscious efforts to record and return kōrero, much of this mātauranga risks being lost alongside our elders, taking with it the ways our ancestors understood land, relationships, and belonging.

This project does not claim to replace being on the land, where knowledge is lived and felt most deeply. Instead, it offers a way of maintaining connection when distance makes return difficult, reminding us that whakapapa does not change and that being Māori is not undone by where we live. In this way, the research affirms that whakapapa endures, belonging is not broken by absence, and the whenua awaits confidently for when its descendants return.

"POU TE WHIWHIA, POU TE RAWEA"

"A post may mark the boundary, but it can be worked around"

My translation of a Ngāti Apakura whakataukī that acknowledges obstacles exist, but pathways can always be found.

- Archibald, J.-A., Lee-Morgan, J., & De Santolo, J. (Eds.). (2019). Decolonizing research : indigenous storywork as methodology. ZED Books LTD.
- Jones, P. T. H. (1974). [Genealogy charts] [Unpublished manuscript]. Pei Te Hurinui Jones Papers (File 3A8_7, pp. 26-33), University of Waikato Library Archives
- Kelly, L. G. (1980). Tainui : story of Hoturoa and his descendants. Gutenberg e-books. http://waikatolibrary.wheelers.co/title/GUTI05TSHHD/epub
- Smith, L. T. (2015). Kaupapa Māori research- Some Kaupapa Māori principles. Te Kotahi Research Institute.

Ngati Maniapoto Marae Pact Trust

THE UNIVERSITY OF WAIKATO
Te Whare Wānanga o Waikato

Methodologies

Pūrākau (narratives) sit at the heart of this work. They include whakapapa, connections to whenua, taniwha, and creation stories which are not fixed histories but living narratives that continue to guide Māori how to be Māori today (Archibald et al., 2019).

Whakapapa

- Tracing hapū and iwi descent lines back to waka.
- Mapping relationships between rangatira, whenua, whānau and marae.
- Using whakapapa to contextualise Land Court narratives.

Kōrero

- Oral and place-based storytelling.
- Semi-structured interviews with kaumātua to capture personal and historical narratives.
- Visiting marae to engage with the land, observe spaces, and understand place-based connections.

Archives

- Māori Land Court minutes.
- Early Māori historians (Pei Te Hurinui Jones; Leslie G. Kelly).
- Published and unpublished manuscripts.
- Microfilm reels.
- Connecting pieces across Maniapoto and wider Tainui pūrākau.

Key Insights

Restricted Access

Early in the research, a wealth of material emerged, including over sixty audio and video recordings of Ngāti Maniapoto kaumātua speaking to their whenua and marae. Much of this knowledge, however, remains inaccessible, held within the National Library, others include the restricted collections such as those of Pei Te Hurinui Jones. While these archives contain invaluable mātauranga, their limited accessibility highlights the importance of Māori data sovereignty and the need for resourcing and pathways that enable meaningful access to these collections.

Whakapapa Foundations

Whakapapa is foundational to pūrākau, situating stories within relationships to land, ancestors, migration, and time. Jones (1974) and Kelly (1980) embed whakapapa alongside pūrākau to trace the movements and connections of tūpuna, while Māori Land Court minutes similarly function as recitations of whakapapa in discussions of land entitlement. Interviews with kaumātua reinforced this, grounding narratives in named ancestors and their ties to marae and whenua. As Smith (2015) argues, whakapapa is inseparable from cultural identity, emerging as a central reference point in this research.

Living Knowledge

Engagement with kaumātua revealed that much of this knowledge already exists within the community. While archives and manuscripts are valuable, the living kōrero of elders often exceeds what is recorded. As rangatahi spend less time on marae, this knowledge risks fading. Through interviews and recordings, this project captures tupuna knowledge, making it accessible for future generations and bridging Māori and Western pedagogies to keep histories alive, relational, and relevant.

EYE ON DESIGN

Tracking The Perception of Heading Hierarchies

Wairua Tahere | Supervisors : Dr Claire Timpany & Nic Vanderschantz

THE UNIVERSITY OF WAIKATO
Te Whare Wānanga o Waikato

RESEARCH OVERVIEW

Which typefaces are easiest to identify?

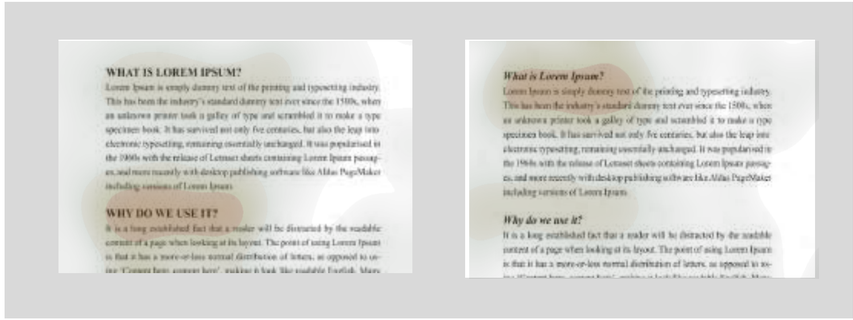
This mixed methods study captures subconscious eye behavior and conscious decision making.

METHODOLOGY

- **Variables:** Systematic variation of size, weight, italics, serfis and caps
- **Task 1 :** 45 paired comparisons of 10 stimuli. Recording decision time, scan path, and fixations
- **Task 2 :** Group ranking. Think aloud protocol (TAP) with prompts. Recording Zoom usage, and facial expressions.

Post- hoc AFFECTIVA analysis identifies positive or negative facial expressions when making judgements

TASK 1 : PAIRED COMPARISONS



Aggregate Area of interest heatmap (pairwise)

TASK 2 : GROUPED RANKING

Lorem Ipsum

Lorem Ipsum

Lorem Ipsum

Lorem Ipsum

Lorem Ipsum

TAP + neutral prompts to capture perceived hierarchy. Cognitive techniques used in comparisons are identified. Zooming in and out used by most participants.

Illustrative group comparison/ranking

PRELIMINARY RESULTS

Bradley-Terry-Luce (BTL) model computes a ’readability’ co-efficient θ for unitary comparisons, and validity testing.

Findings consistent with related work.

KEY FINDINGS : **Bold + Size** consistently ranked highest in perceived hierarchy

CONCLUSION

BTL analysis standardizes metrics in paired sample paradigms. TAP allows for robust validation of perceived ranking. Screen-based paradigms should be explored to strengthen generalizability.

REFERENCES

Software R&D for Ahuora Digital Twin Platform

Author: Khang Tran **Supervisor: Tim Walmsley**

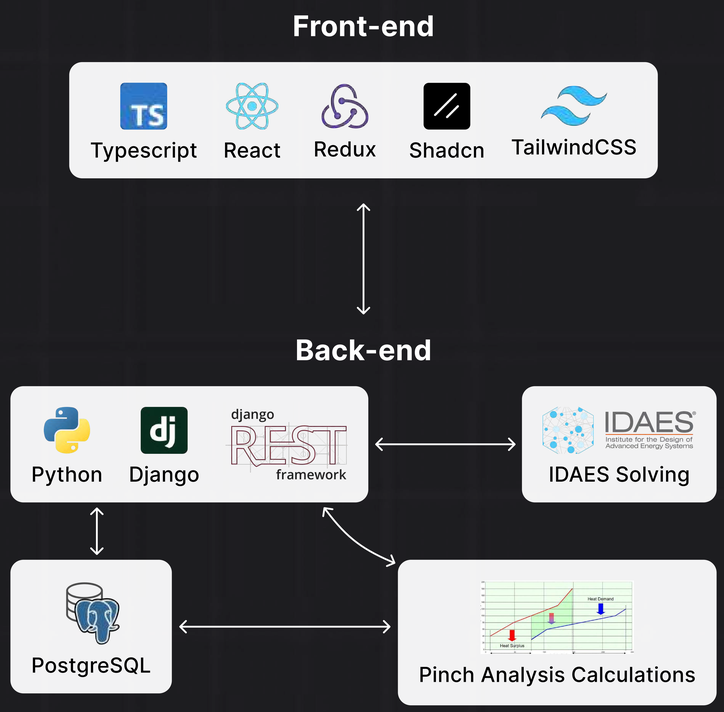
THE UNIVERSITY OF WAIKATO
Te Whare Wānanga o Waikato

Background

Large scale process simulator

Ahuora Adaptive Digital Twin process simulation platform is a platform that **simulate, analyse and optimise** industrial chemical processes. It will be accessible to engineering researchers, service providers and industrial site-owners and is essential to **decarbonise the process heat sector**.

Platform architecture



Contributions

Front-end development

Created UI components and wizards for searching, displaying, selecting, and summarizing properties. Developed design mock-ups and prototypes.

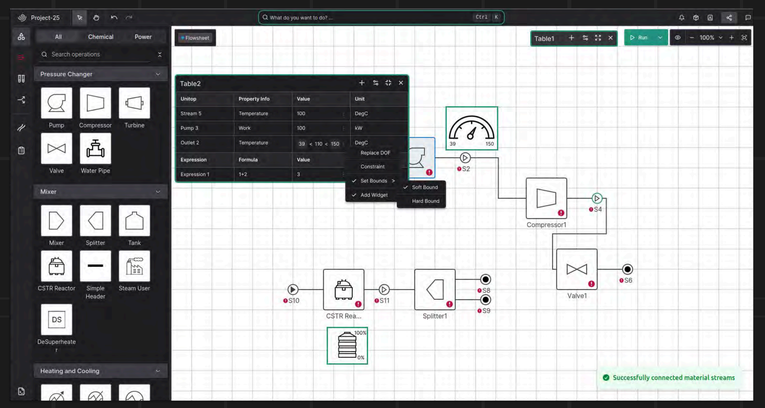
Back-end development

Developed custom API endpoints, performed CRUD operations with PostgreSQL, interacted with IDAES libraries, implemented Django tests, and conducted code refactoring to enhance maintainability.

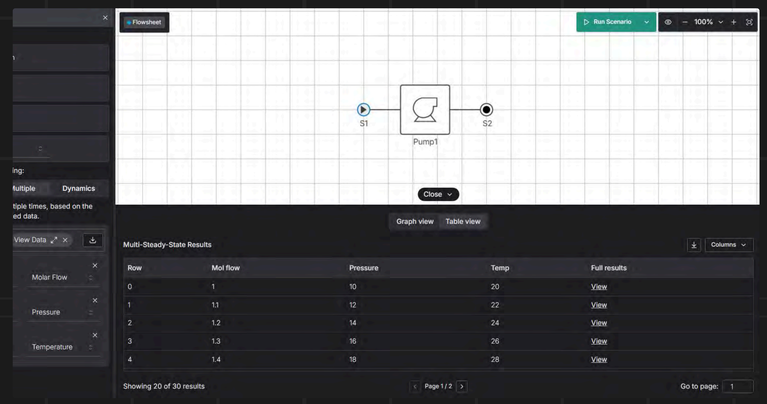
Open Pinch package adoption

Refactored the codebase to adopt the new OpenPinch pip package.

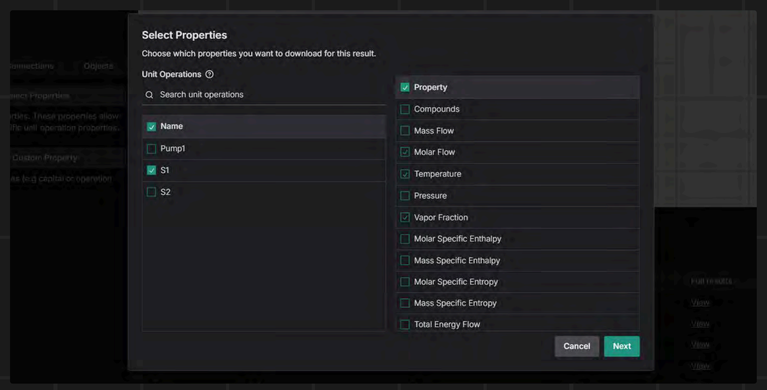
Spreadsheet++ mockup



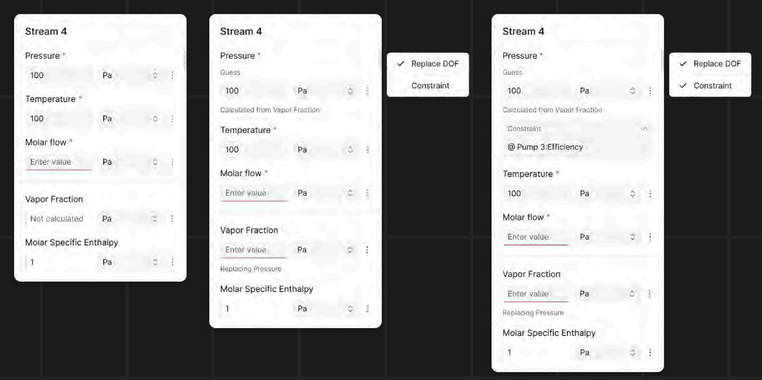
Scenario results in display



Example wizard



Properties panel redesign



Many thanks to Tim Walmsley and the Ahuora software team for the opportunity!

AHUORA
CENTRE FOR SMART ENERGY SYSTEMS

The Manu Meter

Automated Scoring of Manu Jumps

Background

The Tauranga City Council is currently working on their smart city plan, the first step of the project being the Manu Meter.

The Manu Meter project involves a display that shows the swimming & weather conditions, along with a leaderboard of the highest scoring manus

Aim

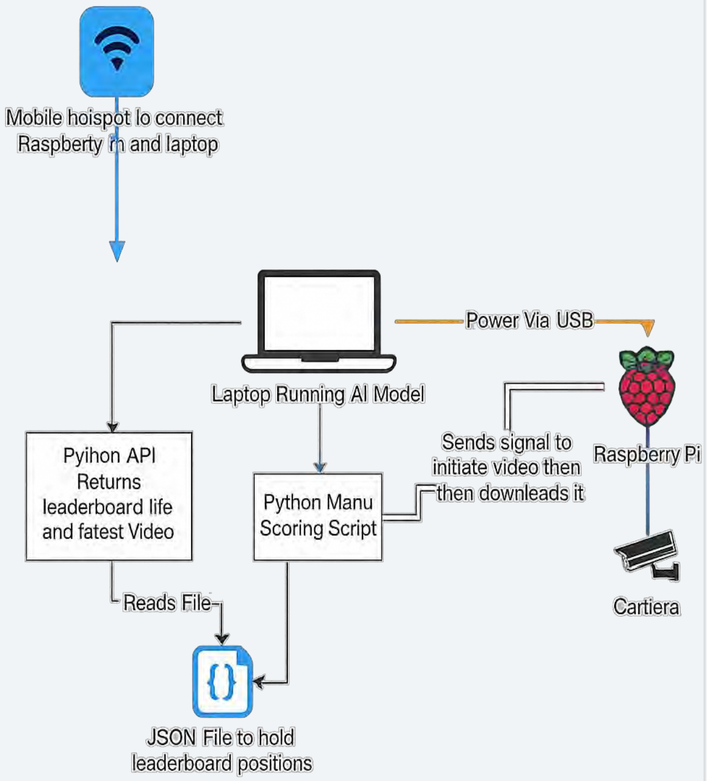
To design a pipeline system which records, analyses, and displays the results of manus into the Tauranga Wharf.

Link to Project

Scan here to view the project on GitHub.

Methodology

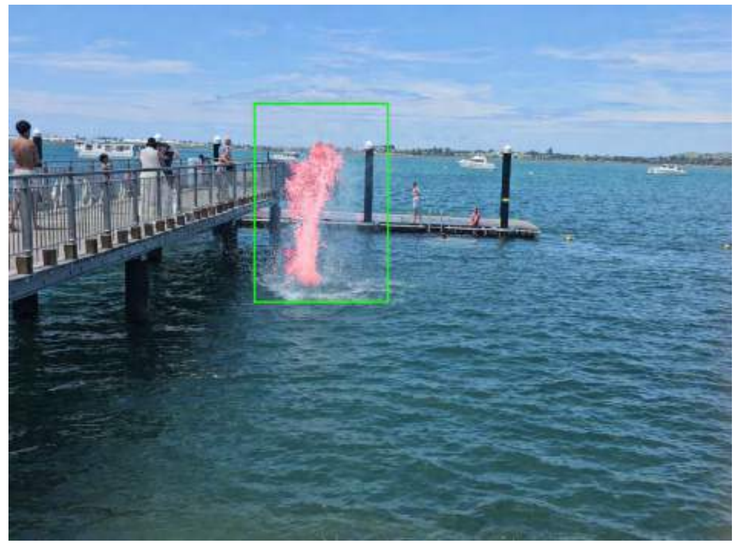
The Manu Meter pipeline consists of three main devices; An AI camera, a raspberry pi, and a local machine.



This pipeline works by recording a video from the camera, saving it on the pi, and using the local machine to run an analysis algorithm using segmenting technology

Results & Conclusion

Testing the Manu Meter at the Tauranga Wharf proved the prototype worked as expected (pictured below).



Future Work

Future work on the Manu Meter includes syncing up local cameras for a fixed view, along with implementing the newest version of the segment model on a more powerful machine. This would allow for quicker and more efficient scoring

By Jack Unsworth, Supervised by Jessica Turner & Dave Parsons.
Acknowledgements: Summer Research Program 25/26, University of Waikato School of Computing, Tauranga City Council.

How Can International Student Teachers become Civic Actors?

Supervisor : Dr. Janina Suppers

Scholar : Apeksha Victor

Background

In a time of intersecting global crises, education systems increasingly rely on teachers who can support young people to become informed, active, and critical citizens. In Aotearoa New Zealand, international students in Initial Teacher Education (ITE) programmes play a growing role in the teaching workforce and bring diverse civic experiences shaped by different social, cultural, and educational contexts. However, little is known about how these international ITE students experience citizenship at university, or how university spaces prepare them to act as civic participants and future educators. This study explores how international ITE students engage with citizenship within and beyond the university, and how these experiences shape their readiness to become civic actors in local communities.

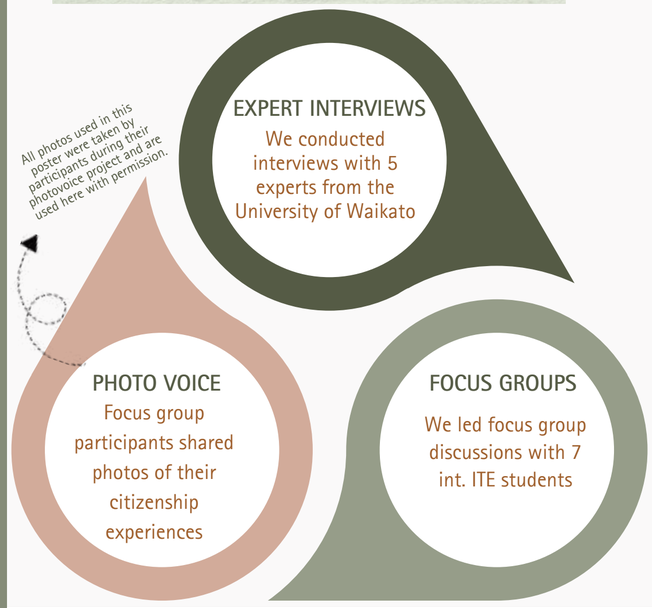
Scan this to know more about the project and references

Research Questions

(1) How do international ITE students experience citizenship at university and beyond?

(2) Which barriers do international ITE students experience when they engage as citizens?

Methods



All photos used in this poster were taken by participants during their photovoice project and are used here with permission.

Findings

Spaces of Belonging

The Pā at uni

Lake at uni

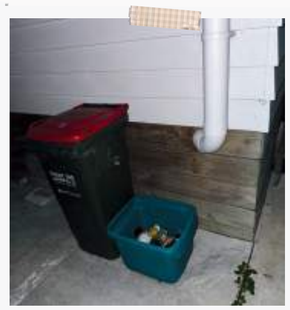
Auckland fireworks

> I spend most of my time at the Pā or at the lake. There's beauty everywhere and in these spaces. I feel I belonged in a new country...
>
> -Morgan *(pseudonym)*

More so than engaging in citizenship activities, international ITE students look for places where they feel they belong, something that feels like home in this new country.

Citizenship Opportunities

Public transport card



Weekly rubbish sorting

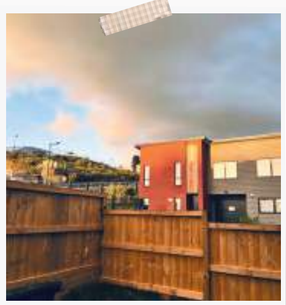
Volunteer card

> WSU board elections are for everyone. If you see, more than 50% of the board is made of international students...
>
> -Drew *(pseudonym)*

Participants were aware of citizenship opportunities in their everyday lives (eg. recycling), clubs & organizations, and politics (eg. protests, WSU elections). However, participants faced many barriers in taking up these opportunities.

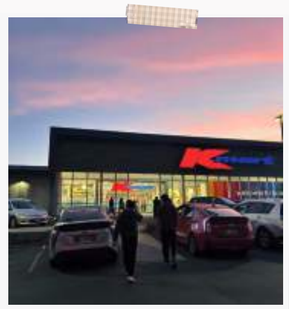
Scan this to learn more about citizenship opportunities

Barriers They Face



Renting house

Medical services



Engaging with locals

> We couldn't participate in the orientation because our placements began. I know there are opportunities, but I don't have time for anything else but my degree...
>
> -Casey *(pseudonym)*

Lack of enough information, visa status that doesn't make them feel like citizens, fear of discrimination and repercussions especially for political engagement, and program and time contraint are their biggest barriers to engage as citizens.

What can we do better?

- Can the faculty become a 'bridge' between international ITE students and the wider university citizenship opportunities?
- Can the university develop students' understanding of politically focused citizenship activities (eg. could some of the existing trips for international students have a political focus such as a trip to the local council)?
- Do the One Year Graduate ITE Programs offer enough time to allow international ITE students to develop as civic actors?

COMING SOON

Keep an eye out for our upcoming survey on this topic!

THE UNIVERSITY OF WAIKATO
Te Whare Wānanga o Waikato

DURABILITY IN A CHANGING CLIMATE

AIM: TO QUANTIFY THE IMPACTS OF CLIMATE CHANGE ON INFRASTRUCTURE IN NEW ZEALAND

INTRODUCTION

Climate change is expected to alter the conditions that drive material degradation (temperature, humidity, rainfall, atmospheric pollutants, and salinity). As New Zealand's infrastructure is commonly designed for 50 to 100 year lifespans, small changes in these variables can translate into major changes in durability, maintenance demand, and lifecycle cost.

This research quantifies how projected end of century climate conditions may change degradation rates for three common construction materials in New Zealand: structural steel (corrosion), reinforced concrete (carbonation and chloride ingress), and timber (biological decay). Established degradation models are applied using current and future climate datasets to estimate the percentage change in deterioration over time, supporting more resilient design and adaptation planning.

This research uses the SSP2-4.5 scenario from the IPCC Sixth Assessment Report (AR6) as the future climate pathway. SSP2-4.5 represents an intermediate emissions pathway used widely for impact and risk assessments. Using SSP2-4.5 provides a consistent, internationally recognised basis for estimating end of century changes in the climate variables that drive material degradation.

DEGRADATION MODELS

STRUCTURAL STEEL

Atmospheric Corrosion – ISO 9223

Atmospheric corrosion of carbon steel and zinc is estimated using the ISO 9223 dose response model, which calculates first year corrosion rate using key climate variables including temperature, relative humidity, chloride deposition, and sulphur dioxide deposition, allowing projected changes in these variables to be translated into changes in corrosion rate and expected material loss.

Carbon Steel:

$$r_{corr} = 1.77 \times {P_d}^{0.52} \times e^{0.02 \times RH + f_{st}} + 0.102 \times {S_d}^{0.62} \times e^{0.033 \times RH + 0.4T}$$

$$f_{st} = -0.054 \times (T - 10)$$

Zinc:

$$r_{corr} = 0.0129 \times {P_d}^{0.44} \times e^{0.046 \times RH + f_{Zn}} + 0.0175 \times {S_d}^{0.57} \times e^{0.008 \times RH + 0.085T}$$

$$f_{Zn} = -0.071 \times (T - 10)$$

r_{corr} is first year corrosion rate of the metal, (µm/a).
T is the annual average temperature, (°C).
RH is the annual average relative humidity, (%).
P_d is the annual average SO_2 deposition, (mg/m²/d).
S_d is the annual average Cl^- deposition, (mg/m²/d).

REINFORCED CONCRETE

Carbonation and Chloride Ingress – fib Model Code

Reinforced concrete degradation is modelled using fib Model Code formulations. Carbonation is estimated by the growth of carbonation depth over time, governed by an effective CO_2 term that depends on environmental conditions and concrete properties, while chloride ingress is modelled as chloride diffusion from the surface to the reinforcement, estimating the time for chloride concentration at steel depth to reach a critical threshold based on surface chloride loading, diffusion parameters, and exposure conditions.

Carbonation:

$$x_c(t) = k_c\sqrt{t};\ k_c = k_0 f_{RH} f_T f_{CO2}$$

$$f_{RH} = \exp[-\beta\,(RH - RH_{opt})^2]$$

$$f_T = \exp[-\frac{E_a}{R}(\frac{1}{T+273} - \frac{1}{292})];\ f_{CO2} = \sqrt{\frac{c_{CO2}}{c_{CO2,ref}}}$$

$x_c(t)$ is is the carbonation depth at time t, (mm).
t is the exposure time, (years).
β is is an empirical humidity sensitivity parameter, (0.002)
RH is the annual average relative humidity, (%).
RH_{opt} is is the optimal relative humidity for carbonation, (65%)
E_a is the activation energy governing reaction, (50 kJmol^{-1})
R is the universal gas constant, (8.314 Jmol^{-1}K^{-1})
T is the annual average temperature, (°C).
C_{CO2} is the atmospheric carbon dioxide concentration, (ppm).
$C_{CO2,ref}$ is the reference atmospheric carbon dioxide concentration used for normalisation, (400 ppm).

Chloride Ingress

$$C(x,t) = C_s[1 - \mathrm{erf}\left(\frac{x}{2\sqrt{D_{app}t}}\right)]$$

$$D_{app} = D_{ref} f_T f_{RH};\ f_{RH} = \frac{(RH-30)}{60}$$

$$f_T = \exp[-\frac{E_a}{R}(\frac{1}{T+273} - \frac{1}{292})];\ C_s = \alpha Cl_{dep}$$

C(x, t) is chloride concentration at depth x and time t
X is the depth from the concrete surface, (mm)
t is the exposure time, (s).
RH is the annual average relative humidity, (%).
E_a is the activation energy governing reaction, (50 kJmol^{-1})
R is the universal gas constant, (8.314 Jmol^{-1}K^{-1})
T is the annual average temperature, (°C).
α is the uptake coefficient of deposited chlorides, (0.3)
Cl_{dep} is the annual average Cl^- deposition, (mg/m²/d).
erf is the error function.
D_{ref} is the reference chloride diffusion coefficient of concrete, (1 0^{-12}m²s^{-1})

TIMBER

Biological Decay – Moisture Temperature Indicator:

Timber durability is assessed using a climate driven decay indicator that links the conditions required for fungal activity to national climate variables. Annual mean temperature and relative humidity are converted to an equilibrium moisture content (EMC), providing an estimate of how moisture prone the timber environment is. A threshold based moisture metric is then used to indicate when conditions approach levels where biological decay becomes possible, allowing projected climate change to be compared in terms of relative decay pressure and the potential for long term strength and service life reduction.

Equilibrium Moisture Content:

$$M = \frac{1800}{M_p}[\frac{Kh}{1-Kh} + \frac{K_1Kh + 2K_1K_2K^2h^2}{1 + K_1Kh + K_1K_2K^2h^2}]$$

$$M_p = 330 + 0.452T + 0.00415T^2$$

$$K = 0.791 + 0.000463T - 0.000000844T^2$$

$$K_1 = 6.17 + 0.000313T - 0.0000926T^2$$

$$K_2 = 1.65 + 0.0202T - 0.0000934T^2$$

M is the equilibrium moisture content, (%).
T is the annual average temperature, (°F).
h is the annual average relative humidity (–).

CLIMATE VARIABLES

Climate variables are the key inputs that control each degradation mechanism modelled in this research. Projected changes in temperature, rainfall, and relative humidity influence how often materials are exposed to moisture and how fast chemical and biological reactions proceed. Changes in atmospheric composition and coastal processes can alter exposure to CO_2, chloride deposition (marine salts), and air pollutants that accelerate corrosion and concrete chloride ingress. As these variables vary strongly by location, this table summarises the current and end of century national average values of climate variables relevant to the models used, providing a consistent basis for comparing how degradation changes under future climate conditions.

Table 1 - Current vs End of Century Climate Variable Values

Climate Variable	Current	End of Century
Air Temperature	13.51 °C	15.11 °C
Rainfall	1800 mm/yr	1800 mm/yr
Relative Humidity	80 %	79 %
CO_2 Concentration	423 ppm	540 ppm
Sea-level Rise	0 m	+ 0.5 m
Chloride Deposition	300 mg/m²/day	360 mg/m²/day
Time of Wetness	4200 hrs	4200 hrs
Maximum Wind Speed	Varied	+ 5 %
SO_2 Deposition	0.2 mg/m²/day	0.15 mg /m²/day

Research Student: Simon Wagstaff
Supervisors: Arthur Fang & Kimi Wang

RESULTS & DISCUSSION

STRUCTURAL STEEL

Atmospheric corrosion is projected to increase for both metals, indicating faster material loss and shorter times to reach corrosion-based limit states. Carbon steel shows a 14.12% increase in corrosion rate, while zinc shows a larger 23.11% increase. When service life is assumed to be controlled by a thickness loss limit state, these increases can be used to measure reduction in service life. The expected service life reduction is 12.37% for carbon steel and 18.77% for zinc, highlighting that protective zinc coatings are particularly sensitive to the projected increase in atmospheric corrosivity.

Key results:

Carbon steel: corrosion rate - 14.12% increase; service life - 12.37% decrease.
Zinc: corrosion rate - 23.11% increase; service life - 18.77% decrease.

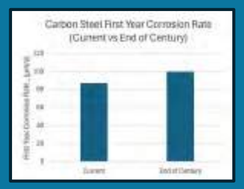


Figure 1 – Carbon Steel First Year Corrosion Rate Comparison.

Figure 2 – Zinc First Year Corrosion Rate Comparison.

REINFORCED CONCRETE

Carbonation depth increases by 19.7% and chloride concentration at reinforcement depth increases by 16.8% after a 100 year exposure. The increase in carbonation rate corresponds to roughly a 30% reduction in time to steel depassivation, reducing the effective service life from 100 years to around 70 years. Chloride ingress is less sensitive to climate change, with a 5% increase in the effective diffusion coefficient resulting in a decrease in chloride effected service life of approximately 5 years. These results indicate that carbonation is the governing durability mechanism under future climate conditions.

Key results:

Carbonation - 19.7% increase; service life - 30% decrease.
Chloride Ingress - 16.8% increase; service life - 5% decrease.

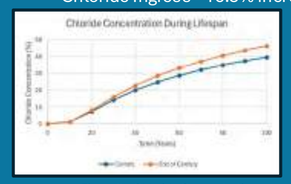


Figure 3 – Chloride Concentration During Lifespan Comparison

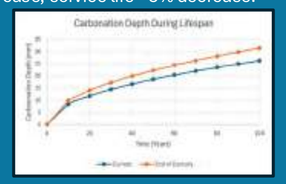


Figure 4 – Carbonation Depth During Lifespan Comparison

TIMBER

The calculated equilibrium moisture content (EMC) for timber shows a small decrease from the current climate to the end of century projection. EMC reduces from 16.3% to 15.9% a decrease of 2.5%. This indicates that New Zealand's average climate is projected to become slightly less moisture-prone for timber. Both values remain below common decay activation moisture levels (20%), meaning decay risk will still be controlled by local wetting events, detailing, and time of wetness rather than annual mean conditions.

Key results:

Current Equilibrium Moisture Content - 16.3%
Projected End of Century Equilibrium Moisture Content - 15.9%

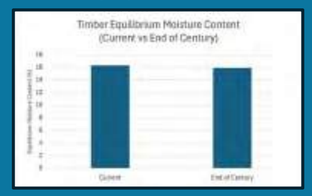


Figure 5 – Timber Equilibrium Moisture Content Comparison

CONCLUSION

Overall, this study shows that climate change is projected to measurably reduce the long term durability of key New Zealand construction materials by changing the environmental factors that drive the degradation. Using established climate driven models the end of century climate scenario produces consistently more extreme exposure conditions and higher predicted deterioration rates. For metals, the projected corrosion rate increases noticeably, 14.12% for carbon steel and 23.11% for zinc, implying faster section losses and protective coating breakdown, reinforced concrete degradation also shows a large increase by the end of the century. In contrast, timber decay is expected to slightly decrease, suggesting timber durability risk may remain broadly similar at a national scale. Overall, these results indicate shorter service lives and more frequent maintenance for some common materials unless durability focused adaptations are adopted.

LIMITATIONS

A key limitation in the research is the uncertainty in predicting long term durability from simplified degradation models. While commonly used, these models are not able to represent all local conditions, so results should be treated as indicative trends rather than precise predictions. Using national averages for climate variable values also masks major regional differences and can miss threshold driven effects and extremes that often control degradation. Finally, climate projections are scenario based and not guaranteed, each scenario is a representation of societies future decisions projected change in the climate based on the decisions. The climate models spread as time increases meaning the magnitude of change could be higher or lower than estimated.

TE RĀ IN VR

Punua Waitoki, under
Donna Campbell, Annika Hinze,
& Nic Vanderschantz
Special thanks to Parthiv Kanji
and the *Haunui* crew

WHAT IS TE RĀ?

Te Rā (lit. "the sail") is the only known traditional woven sail to have survived into the modern day.

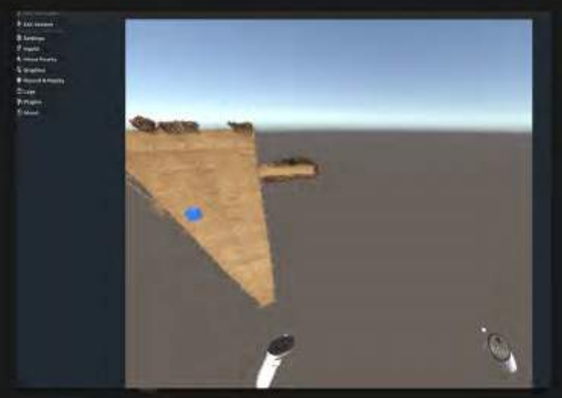
WHAT ARE WE DOING WITH IT?

This summer project focuses on designing a VR simulation centering a 3D model of te Rā.

The ultimate idea is a virtual display of te Rā so that it can be seen outside of the museum it is held in, and in scenarios that are infeasible for the real thing, such as being rigged up on a virtual boat.

WHAT HAVE WE MADE?

As of the creation of this poster a basic prototype has been put together featuring the ability to view a static model of te Rā in VR and move it around with controllers.



WHAT'S NEXT?

Expanding the protoype, e.g. a mast or waka hourua for te Rā's 3D model to be mounted on, rigging the model to be able to simulate fabric physics like a real sail, implementing ocean and wind sounds.

THE UNIVERSITY OF WAIKATO
Te Whare Wānanga o Waikato

No AI was used in the creation of this poster

Te Puna Haumaru
Security and Crime Science
THE UNIVERSITY OF WAIKATO

Analysing Variation in Home Invasion Robberies

Charlotte Ward, Dr Devon Polaschek

THE UNIVERSITY OF WAIKATO
Te Whare Wānanga o Waikato

1.Background

- Prior research has examined crime events as structured sequences, identifying variation in how offending unfolds.[1, 2]
- Building on this approach, the present study draws on judges' sentencing decisions and media reports to map distinct patterns in home invasion robberies.
- Research Question: *How do home invasion robberies vary in their offence processes, and what do these variations reveal about offender decision-making and victim outcomes?*

2.Method

26 events coded, supplemented by media reports

Event flow charts constructed

Data analysed for recurring patterns

Victims are usually known to their offenders, and events are typically motivated by:

- Prior disputes
- Drug-related 'taxings' or debt enforcement
- Gang-related activity

3.Findings

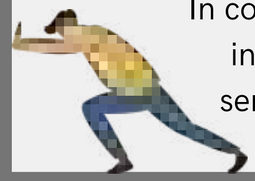
Offenders use different strategies to establish and maintain victim compliance:

Weapons

Threats

Physical force

Victim compliance is associated with reduced harm



In contrast, resistance increases risk of serious injury and fatality

4.Implications

- Home invasions are usually targeted rather than random.
- Victim-focused prevention advice is not one-size-fits-all.
- Drug use and gang involvement increase risk of victimisation.

References

1. Chiu, Y. N., & Leclerc, B. (2016). An examination of sexual offenses against women by acquaintances: The utility of a script framework for prevention purposes. In Crime prevention in the 21st century: Insightful approaches for crime prevention initiatives (pp. 59-76). Cham: Springer International Publishing.
2. O'Hara, A. C., Ko, R. K., Mazerolle, L., & Rimer, J. R. (2020). Crime script analysis for adult image-based sexual abuse: A study of crime intervention points for retribution-style offenders. Crime Science, 9(1), 26.

ENHANCING COMMUNITY CONNECTIVITY THROUGH IMPROVED PATHWAY LINKAGES IN TAURANGA

THE UNIVERSITY OF WAIKATO

INTRODUCTION

Shared pathways play a key role in supporting active transport, community connectivity, and wellbeing. As Tauranga continues to grow, demand for safe and connected walking and cycling routes is increasing. While the city has invested in shared pathways over time, the network remains fragmented in places, with missing links, safety issues, and uneven access across communities. This research applies an evidence-based multi-criteria decision analysis to prioritise shared pathway investments that maximise connectivity, safety, and equity in Tauranga.

CORE AIMS

1) Community Feedback Analysis
2) Development of Priority Investment List
3) Pathway Network Review & Multi-Criteria Analysis

OBJECTIVE

> Understand and improve the way the Tauranga community connects with its shared pathway infrastructure.

WHY THIS PROJECT MATTERS?

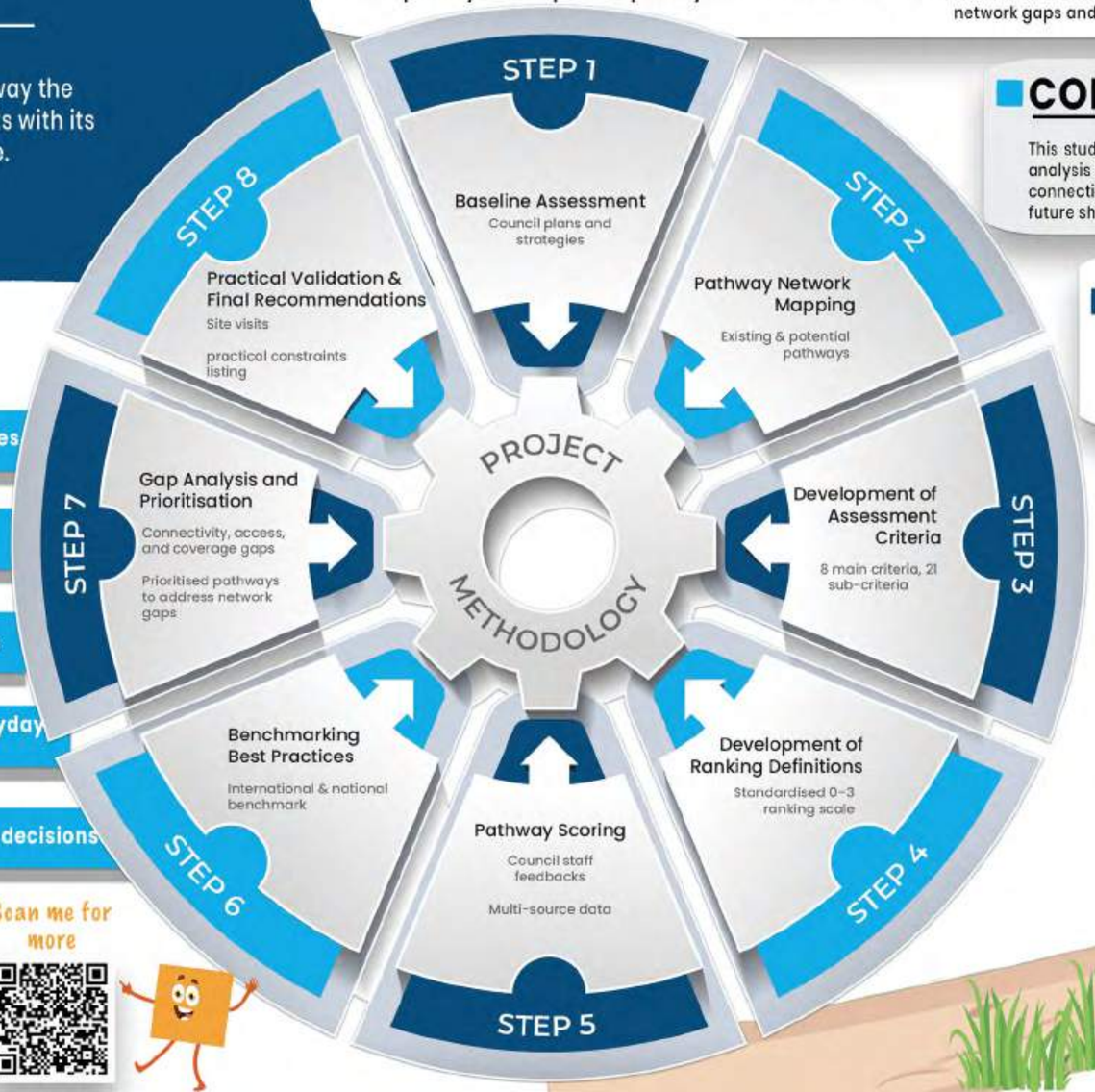
- Safer walking and cycling routes
- Fairer access for all communities
- Respecting cultural values and places
- Better connections between everyday places
- Guiding future investment decisions

RESULTS

Following the initial baseline assessment, a total of **91 existing shared pathways** and **128 potential pathway links** were identified.

After scoring the 128 potential links, **40 links** with scores greater than **32 out of 63** were identified as having the greatest potential to fill network gaps and enhance community connectivity.

After ground-truthing 40 pathways, considering **cost, community constraints & land ownership, 10** priority shared pathways were identified, offering strong connectivity and also feasibility.



CONCLUSION

This study developed a structured, multi-criteria framework to assess shared pathway connectivity in Tauranga using spatial analysis and multiple data sources. The results identify key network gaps and priority pathway links that can improve connectivity, safety, and equitable access across the city. The framework provides a practical, evidence-based tool to support future shared pathway planning and investment decisions in Tauranga.

LIMITATIONS OF THE STUDY

1. Some subjectivity is unavoidable when applying multi-criteria scoring.
2. The absence of weighting may under- or over-emphasise certain criteria.
3. As a result, some important pathways are under-rated while others are over-rated.

NEXT STEPS

Weighted criteria:
Refine the framework by applying weighted criteria to better represent priority outcomes.

Post-implementation monitoring:
Track real-world performance of implemented pathways to assess use, safety, and accessibility.

Citywide impact evaluation:
Examine longer-term impacts on travel behaviour and how shared pathways shape the city's movement patterns.

Scan me for more

References

- Tauranga City Council. (2023). Transport system plan. Tauranga, New Zealand: Tauranga City Council.
- Tauranga City Council. (2024). Tauranga long-term plan 2024–2034. Tauranga, New Zealand: Tauranga City Council.
- Auckland Council. (2021). Auckland long-term plan 2021–2031. Auckland, New Zealand: Auckland Council.

Acknowledgement

Design - Malsha Manohari
Supervisors - Dr Christina Hanna, Amy Tailor
Acknowledgement - Shae Gray and Lee Martin (University of Waikato)
- Marlene Herewini (Tauranga City Council)

Tauranga City

Ngā Taonga Tuku Iho

Audio / Visual Taonga within Te Pua Wānanga ki te Ao

Jess Wharekura - Supervised by Ahorangi Tangiwai Rewi

THE UNIVERSITY OF WAIKATO
Te Whare Wānanga o Waikato

Te Pua Wānanga ki te Ao

Background

Within Te Pua Wānanga ki te Ao is a rich collection of oral histories, collected in an archive of audio and visual taonga. Within this collection are over 550 reel to reel tapes, as well as over 800 cassette tapes, CD's and VHS', all holding important pūrākau, waiata and kōrero. The goal of this project was to create an inventory, and increase the accessibility of this collection.

This project is a continuation of the work of Molly Huggan, who worked exclusively with the reel to reel collection and created a comprehensive catalogue of these.

Methods

Extensive work was undertaken with this collection to create an accessible archive. Each individual taonga was logged into a new digital catalogue, in the same system which the reel to reel tapes had been previously catalogued. Each of these taonga were also assigned a new reference number, as many were missing. These catalogues were then amalgamated into an inventory of the entire collection.

Each taonga was also cross checked against external archives, to identify which of our taonga have been previously digitised, and which are unique to this collection. Close to 200 taonga were also found in the Ngā Taonga Sound and Vision collection. Through working with Ngā Taonga Sound and Vision, we are in the process of gaining digital access to these taonga.

Alongside this work, physical storage of the collection was greatly improved. Taonga were rereferenced and reboxed into a cohesive system, and boxes were relabelled. The collection was also moved into a dedicated space holding only taonga.
Once this was complete, new frameworks were created and recommended for accessing taonga, collection of new material, as well as the future governance of Ngā Taonga Tuku Iho.

Key Insights

This project has resulted in a framework to be able to protect, preserve and provide access to Ngā Taonga Tuku Iho for the future, allowing the knowledge within these taonga to be passed down to the next generation. In building this framework, it was imperative to ensure we are not transplanting a system which perpetuates colonial harm, as many archiving systems have before.

A review was undertaken of Indigenous declarations and policies created to guide collection and archiving practices of Indigenous data and taonga. During this review, it was noticed that most literature around Indigenous data sovereignty and decolonial archiving practices pertained to western institutions which hold Indigenous taonga. Ngā Taonga Tuku Iho comes from a different starting point, being held exclusively within Te Pua Wānanga ki te Ao, an Indigenous space within the university. We have an opportunity to begin envisioning a future of collection practices set out by Māori, for Māori and with Māori (Tuhiwai-Smith, 1999), just as this collection was created. It is imperative that we are critical and creative about the future of Ngā Taonga Tuku Iho and the potential this collection has to improve and decolonise practices pertaining to taonga Māori.

Two frameworks have been recommended for the future guidance of Ngā Taonga Tuku Iho. Drawing on the work of Te Kāhui Rauranga, it was recommended the Te Mana Rauranga Principles of Māori Data Sovereignty (Kukutai et at., 2023) were implemented into the future governance of Ngā Taonga Tuku Iho. The Te Kete Tū Ātea (Gifford & Mikaere, 2019) information framework, implemented by Rangitīkei iwi has also been recommended to guide future collection practices, ensuring that future taonga collected work towards iwi, hapū and whānau aspirations.

Watch Aku Mahi Whatu Māori

Conclusion

"Storytelling not only challenges or decolonizes institutions, it is a way of reasserting Indigenous voice, perspective, and experience. Storytelling is an act of sovereignty that reinforces Indigenous identity, values and worldview" (Behrendt, 2019)

Taonga within Ngā Taonga Tuku Iho have the potential to act as a bridge for ancestral connection and intergenerational transmission of kōrero, waiata, and pūrākau, both transporting us to the past and guiding us into the future (Pihama, 2019). There is a need for continued engagement with this collection, but also a need to continue developing robust practices which facilitate connection and protection for taonga Māori.

References

Barclay, B (Director). (1978). *Aku Mahi Whatu Māori.* Pacific Films. Ngā Taonga Sound and Vision.
Behrendt, L. (2019). Indigenous Storytelling. Decolonizing Institutions and Assertive Self-determination: Implications for Legal Practice. In Archibald, J., Xiiem, Q., Lee-Morgan, J. & De Santolo, J (Eds.), *Decolonizing Research, Indigenous Storywork as Methodology* (pp. 175- 186). Zed Books.
Gifford, H., Mikaere, K. (2019). Te Kete Tū Ātea: Towards claiming Rangitikei iwi data sovereignty. *Journal of Indigenous Wellbeing.* 4(1) 6-14.
Huggan, M. (2025). *Te Pua Wānanga ki Ngā Taonga Tuku Iho. The Reel to Reel Audio Taonga Collection.* The University of Waikato.
Kukutai, T., Campbell- Kamariera, K., Mead, A., Mikaere, K., Moses, C., Whitehead, J. & Cormack, D. (2023). *Māori Data Governance Model.* Te Kāhui Rauranga
Pihama, L. (2019). Whanau storytelling as Indigenous pedagogy: Tiakina te pa harakeke. In J.-A. Archibald, J. Lee-Morgan, J. De Santolo, & L. T. Smith (Eds.), *Decolonizing Research: Indigenous Storywork as Methodology* (pp. 137–150). Zed Books.
Tuhiwai Smith, L. (1999). *Decolonising Methodologies.* Zed Books.

Image References

Ranli Wickramaratne

Te Kura Toi Tangata - Division of Education

Into the Unknown – Finding the Locale of the Learner at the Cultural Interface

SUPERVISOR

Dr. Brent Wagner

Introduction - Understanding the Learners' Worlds

This research investigated how learners navigate the cultural interface, where Indigenous and Western knowledge systems meet (Nakata, 2007). The study aimed to learn more about the Locale of the Learner (LoTL), which encompasses the cultural, historical, linguistic, and community-based contexts that learners bring to classrooms, and how these locales shape identity, engagement, and meaning-making.

Specifically, a review of recent scholarship (2020–2026) showed that the cultural interface is a dynamic, contested and relational space shaped by power, history, and positionality. This literature review explored how learners navigate these tensions. Specifically, how educators position themselves, and how transformative learning becomes possible when Indigenous perspectives, relationality, and culturally responsive practices are at the centre. These insights will guide the exploration of what this means for secondary school classrooms, where students who navigate dual knowledge systems do so while building confidence, identity, and engagement.

Method

A time-bound, small-scale systematic literature review of peer-reviewed studies published between 2020 and 2026 was conducted. The focus was on studies that applied, extended, or critiqued Nakata's cultural interface and/or the Locale of the Learner. The review examined research across:

- Higher education
- Initial teacher education
- Curriculum co-creation
- Educational policy
- Culturally responsive pedagogies
- Indigenous student wellbeing and identity

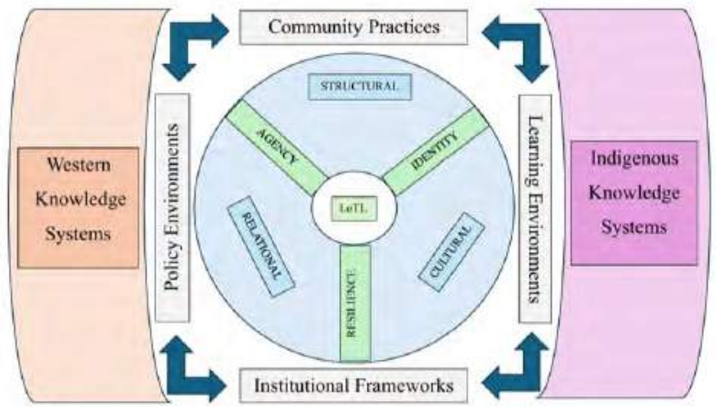
Key areas included: the cultural interface as a site of tension and possibility; the Locale of the Learner as a culturally grounded position; transformative learning and policy contexts shaping learner experience.

An initial search identified 18 articles relevant to the cultural interface and learner positioning. Following screening, 10 articles were included in the final review. Eight articles were excluded for several reasons: some focused on policy, curriculum, or teacher practice without foregrounding learner voice or experience. Additional exclusions were made where studies narrowly conceptualised learning environments , focusing only on the physical classroom atmosphere (such as furniture arrangement, seating, or spatial design) without engaging with learners' cultural, relational, or epistemic positioning.

Results - Insights from the Interface

- Learners navigate complex tensions at the cultural interface (Andrews et al., 2024).
- Educators and students navigate discursive tensions between Indigenous and Western knowledge systems (Steele, 2024).
- Policy and structural forces shape the Locale of the Learner (Street, 2023).
- Co-creation and Indigenous-led approaches support cultural safety (Delbridge, 2022).
- The four R's—respect, responsibility, reciprocity, and relationships—play a crucial role in reducing epistemic tensions (Riley, 2024).
- Identity, agency, and resilience are shaped by the Locale and support systems (Durmush et al., 2024).
- Culturally responsive supports, peer networks, and the recognition of community knowledge enable students to feel capable, affirmed, and empowered (Sam & McDowall, 2024).
- Reflexivity and layered spaces enable transformative pedagogy (McDowall, 2021).
- Transformation occurs through relationships and identity growth (Hill et al., 2023).
- Active epistemic agency is characteristic of students' cultural interfaces and their learner locales (Wagner et al., 2026)

Based on the essence of the findings, we developed a conceptual model of learning at the cultural interface. The model positions the learner's Locale as a central, relational space shaped by policy and structural forces and characterised by tensions between Indigenous and Western knowledge systems.



THE UNIVERSITY OF WAIKATO
Te Whare Wānanga o Waikato

Conclusion - Implications for Practice

This review showed that learning at the cultural interface is deeply influenced by the Locale of the Learner, requiring educators to recognise the cultural, relational, and structural dimensions shaping Indigenous students' experiences.

Across contexts, transformative learning arises when teaching is relational, reflective, culturally aligned, Indigenous-led, and grounded in students' locales. Classrooms that acknowledge Indigenous knowledge systems, integrate co-created approaches, and prioritise identity and wellbeing can become sites of confidence, engagement, and belonging.

These findings highlight the need for teachers to:

- Understand their own positionality
- Value Indigenous knowledges alongside Western knowledges
- Foster cultural safety through relational pedagogies
- Recognise policy and institutional influences
- Support identity, agency, and academic buoyancy

Awareness of the Locale of the Learner enables Indigenous students to navigate the cultural interface, contributing to more transformative educational experiences, leading to more equitable outcomes.

Research on the cultural interface and learner locale in school settings is scarce. Moving forward there is an urgent need to build a stronger evidence base for future practice.

References

Andrews, S., Gallant, D., & Mazel, O. (2024). Shifting the terrain, enriching the academy: Indigenous PhD scholars' experiences of and impact on higher education. *Higher Education, 88*, 2123–2143. https://doi.org/10.1007/s10734-024-01207-z

Delbridge, R., Garvey, L., Mackelprang, J. L., Ward-Pahla, E., Egand, M., & Williams, A. (2022). Working at a cultural interface: Co-creating Aboriginal health curriculum for health professions. *Higher Education Research & Development, 41*(5), 1483–1498. https://doi.org/10.1080/07294360.2021.1927999

Durmush, G., Craven, R. G., Yeung, A. S., Mooney, J., Horwood, M., Vasconcellos, D., Franklin, A., Duncan, C., & Gillane, R. (2024). Enabling Indigenous wellbeing in higher education: Indigenous Australian youth-devised strategies and solutions. *Higher Education.* https://doi.org/10.1007/s10734-023-01067-z

Hill, B., Nilson, C., Uink, B., & Fetherston, C. (2023). Transformation at the cultural interface: Exploring the experiences of Aboriginal and Torres Strait Islander university students. *The Australian Journal of Indigenous Education, 52*(2).

McDowall, A. (2021). Layered spaces: A pedagogy of uncomfortable reflexivity in Indigenous education. *Higher Education Research and Development, 40*(2), 341–355. https://doi.org/10.1080/07294360.2020.1756751

Riley, T., Meston, T., Cutler, C., Low-Choy, S., McCormack, B. A., Kim, E.-J. A., Nakar, S., & Vasco, D. (2024). Weaving stories of strength: Ethically integrating Indigenous content in teacher education and professional development programmes. *Teaching and Teacher Education, 142,* 104513. https://doi.org/10.1016/j.tate.2024.104513

Sam, T., & McDowall, A. (2024). "Smooth seas never made a skilled sailor": Indigenous students' academic buoyancy and the locale of the learner. *The Australian Journal of Indigenous Education, 53*(1). https://doi.org/10.55146/ajie.v53i1.1016

Steele, C., Gower, G., & Benson, S. (2025). Non-Indigenous Initial Teacher Education students navigating the cultural interface. *Critical Studies in Education, 66*(4), 498–516. https://doi.org/10.1080/17508487.2023.2298200

Street, B. (2023). Negotiating Indigenous higher education policy analysis at [complete article title]. *Critical Studies in Education, 64*(3), 250–266. https://doi.org/10.1080/17508487.2022.2083647

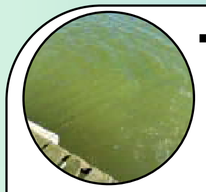
Wagner, B.R., France, B. & McKinley, E. (2026). Intersecting knowledge worlds: describing the cultural interfaces within a socioscientific issue. *Cultural Studies of Science Education.* https://doi.org/10.1007/s11422-025-10269-z

If It's Green, Is It Clean? Laboratory-Based Chlorophyll-*a* Assessment of Algal Biomass in Lake Rotorua

Kendall Williams[1], Whitney Woelmer[1], Deniz Özkundakci[1] and Amohia Peka[2]

Te Aka Mātuatua-School of Science [1] | Te Arawa Lakes Trust [2]

Introduction



- **Algal blooms** are a growing issue in freshwater lakes globally, driven by land-use and climate change. Blooms degrade water quality, pose human and ecosystem health risks, and restrict recreational use.

- **Chlorophyll-*a*** (**chl-*a***), the primary photosynthetic pigment in algae, is widely used as a proxy for algal biomass. **Laboratory-based chl-*a* analysis** is the **gold-standard method**, but is time- and resource-intensive, limiting its use for rapid management decisions[1].
- Hand-held fluorescence sensors (e.g., the **FluoroQuik**) provide low-cost, real-time estimates of algal biomass, and have strong potential for operational monitoring, but require validation against laboratory measurements.
- **Lake Rotorua** (Fig. 1), a shallow, polymictic & eutrophic lake within the Te Arawa Lakes system, experiences recurrent algal blooms, making it an ideal case study to address my **Study Objectives**:
  - **1.** Quantify algal biomass using gold-standard laboratory chl-*a* analysis (**Fluorometer**) across spatial (multiple shoreline sites) and temporal (sampling dates) scales.
  - **2.** Ground-truth hand-held fluorescence sensors (**FluoroQuik**) against laboratory measurements to support management decisions and forecasting.

- This study supports **LakeCast**, a collaborative algal bloom forecasting project led by the University of Waikato (UoW) in partnership with **Te Arawa Lakes Trust (TALT).**

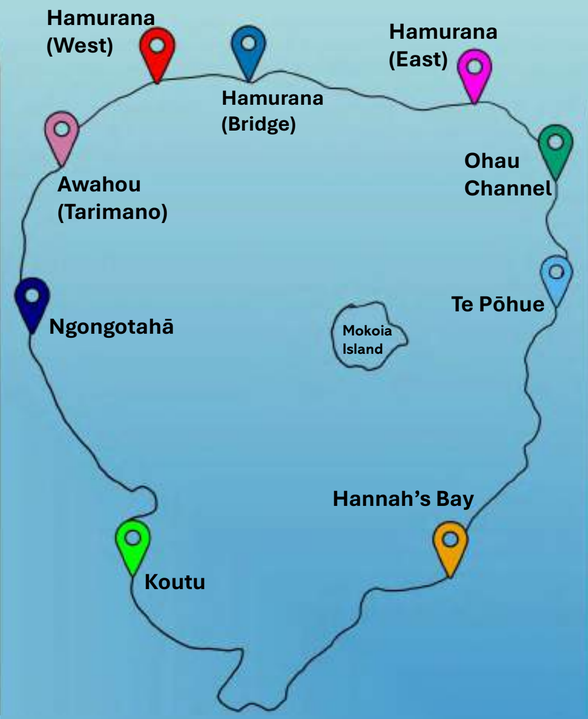


Figure 1. Map of Lake Rotorua, New Zealand, showing the 9 shoreline sampling locations.

Results

Obj. 1: ***Seven of nine sites exceeded the NPS-FM Band A maximum threshold in Week 6.***

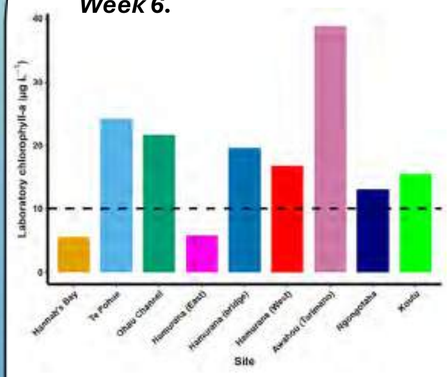


Figure 2. Bar chart showing a snapshot of Week 6 laboratory chl-*a* (µg L^{-1}) across nine sites around Lake Rotorua. Dotted black line shows the 10 µg L^{-1} NPS-FM² threshold for Band A maximum chl-*a*.

Obj. 1: ***Chl-a varied strongly across sites and weeks, indicating high spatial and temporal heterogeneity.***

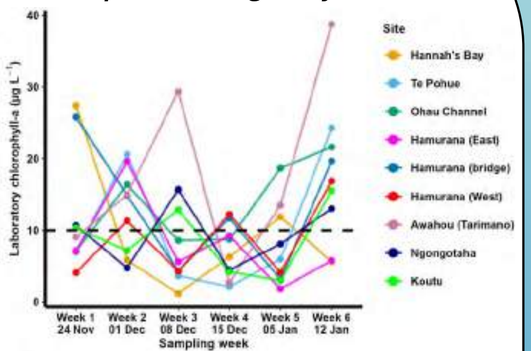


Figure 3. Time series of laboratory chl-*a* (µg L^{-1}) across nine sites around Lake Rotorua over six weeks of sampling. Coloured points and lines represent individual site-week observations. Dotted black line represents the 10 µg L^{-1} NPS-FM² threshold for Band A maximum chl-*a*.

Obj. 2: ***Across all sites and dates, there was a significant, positive relationship between laboratory and FluoroQuik chl-a.***

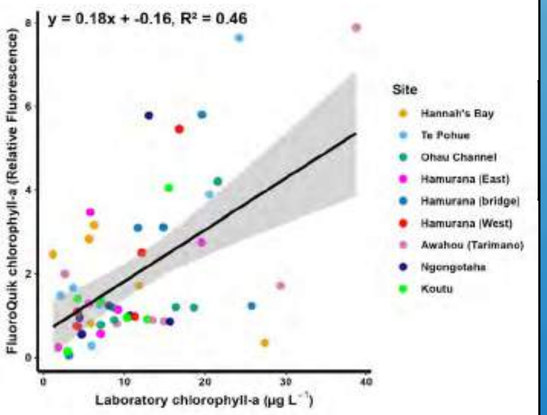


Figure 4. Global linear regression showing the relationship between laboratory-measured chl-*a* (µg L^{-1}) and FluoroQuik (hand-held sensor) chl-*a* (relative fluorescence units) across nine shoreline sites around Lake Rotorua over six weeks of sampling. Points represent individual site–week observations, and the solid line indicates the overall regression ($p < 0.001$).

Methods

1. SAMPLE COLLECTION & FILTRATION

- 9 sites x 6 weeks (Fig. 1)
- 20 mL lake water filtered via GF/C glass fibre filters
  - Same-day FluoroQuik data collection

2. SAMPLE HANDLING & STORAGE

- Filters removed, folded in aluminium, sealed in bags
- Stored cold in field → frozen at −20 °C until analysis

3. CHL-*A* PREP & EXTRACTION

- 10 mL buffered acetone added to filters
- Samples blended up with homogeniser to extract chl-*a*
- Samples steeped cold in the dark (24 h)

4. FLUOROMETRIC ANALYSIS

- Samples centrifuged (10 min, 3300 RPM) → separates pigment extract
- Fluorometer blanked with buffered acetone and HCl
- Readings taken pre- and post-acidification (HCl) → removes influence of degraded chl-*a* (pheophytin)

Conclusions

- **Laboratory chl-*a*** revealed **strong spatial and temporal variability** in nearshore algal biomass, with multiple sites and weeks exceeding NPS-FM Band A thresholds for maximum chl-*a*, indicating a persistent bloom risk in Lake Rotorua (**Obj. 1**).
- **Bloom patterns** were **highly heterogeneous** among shoreline sites within a week, suggesting local drivers (e.g., wind-driven accumulation and hydrodynamics) contribute to bloom movement (**Obj. 1**).
- **Laboratory and FluoroQuik chl-*a* measurements** showed a **statistically significant but weak positive relationship,** suggesting that hand-held sensors capture broad algal trends but explain limited variability in laboratory-measured biomass (**Obj. 2**).
- **Next steps: (1) site-by-site analyses** to assess whether neighbouring sites experience similar bloom events, and **(2)** further **investigation** of **deviations** from the expected trendline between methods (Fig. 4).
  - **Site-specific discrepancies** may be influenced by weather conditions (e.g., wind), low chl-*a* concentrations approaching FluoroQuik detection limits, and interference from other dissolved particles (e.g., geothermically-driven silica and organic carbon).

References

1. Thomson-Laing, G., Puddick, J., & Wood, S. A. (2020). Predicting cyanobacterial biovolumes from phycocyanin fluorescence using a handheld fluorometer in the field. *Harmful Algae*, 97, 101869.
2. Ministry for the Environment. (2025). *National Policy Statement for Freshwater Management 2020 (as amended December 2025)*. New Zealand Government.

Acknowledgements

This research was conducted as part of the **LakeCast** project. I thank **Whitney**, **Deniz**, and **Amohia** for their guidance and support throughout the project. I acknowledge **Te Arawa Lakes Trust** and the **University of Waikato (School of Science)** for institutional support and collaboration. Thanks go to **Chloe Kayll-Irvine** and **Kat Rowe** for laboratory and field assistance. We also acknowledge all partners involved in LakeCast for their contributions toward improving algal bloom monitoring and forecasting in Lake Rotorua. Thank you to the Summer Research Scholarship 2025 Programme for this opportunity.

Māori Perspectives in the Evaluation of a Māori Cultural Embeddedness Psychometric Measure

Supervisor: Dr Ririwai Fox
Research assistant: Shaye Woolford

School of Psychological and Social Sciences
Te Whare Wānanga o Waikato
The University of Waikato

BACKGROUND

Dr Ririwai Fox introduced the concept of cultural embeddedness[1], with the aim of developing a psychometric measure that supports quantitative research theoretically grounded in indigenous Māori worldviews.

Psychometric research produces robust methods for developing and evaluating psychological measures, with strong emphasis on statistical performance, reliability, and validity.

Generally, there is less focus on incorporating the perspectives of the people the measure is being designed for.

This component of the project was to analyse subjective data to generate high-level cross-cutting themes from three wānanga to support recommendations for revising items in The Māori Cultural Embeddedness Scale (MaCES)[2].

REFERENCES

1. Fox, Ririwai (2023). Poipoia te Kākano i Ruia Mai i Rangiātea: Māori Cultural Embeddedness - From Theory to Measure. Open Access Te Herenga Waka-Victoria University of Wellington. Thesis. https://doi.org/10.26686/wgtn.24201651
2. Fox, R., Johnson, F. N., Winter, T., & Jose, P. E. (2023). The Māori Cultural Embeddedness Scale (MaCES): Initial Evidence of Structural Validity. Cultural diversity & ethnic minority psychology, 29(4), 551-563. https://doi.org/10.1037/cdp0000590

METHOD

Wānanga across different regions (*N* = 23)

Transcription, cleaning, and accuracy checks

Iterative coding, content analysis, reflexive thematic analysis to identify recurring patterns

INTERM RESULTS

The response process and construct validity are shaped by participants' self-understanding over time, including reflections on past, present, and aspirational selves in their social and relational contexts

Tensions exist between psychometric assumptions of stability and linearity and te ao Māori worldviews, with cultural embeddedess depending on accessibility and opportunity

EARLY RECOMMENDATIONS

- **Allow for responses that reflect the varying ways that values, beliefs, and practices show in behaviour**
- **Incorporate temporal and developmental response options**
- **Consider intergenerational effects on cultural accessibility and opportunity**

OUTCOMES

We generated qualitative insights into how Māori participants experience and interpret a measure of cultural embeddedness during and after administration. This analysis identified patterns that will inform ongoing refinement of the scale.

NEXT STEPS

Continue coding remaining data and alternative measurement concepts

Peer briefing and reliability checks

Environmental adaptive robot trajectory planner

Zaimei Xing, supervised by Dr Ben Chang

THE UNIVERSITY OF WAIKATO
Te Whare Wānanga o Waikato

Introduction

In robotics, path planning allows robot to navigate from a start point to a goal while avoiding obstacles. Traditional and many modern planning algorithms can be computationally expensive, requiring significant processing time, memory, and hardware cost. Our research aims to explore adaptive sampling method to develop a new path planner that directly addresses these performance bottlenecks.

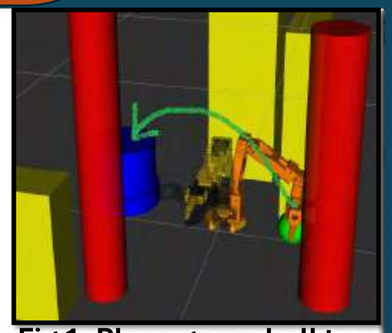


Fig 1: Place green ball to blue bucket

Method

$$q_{(\text{sample})} = c_i + \sigma \cdot z, z \sim N(0, I_n)$$

c_i: obstacle center with margin
I_n: identity covariance matrix

Fig 2: Margin ensures clearance from obstacles

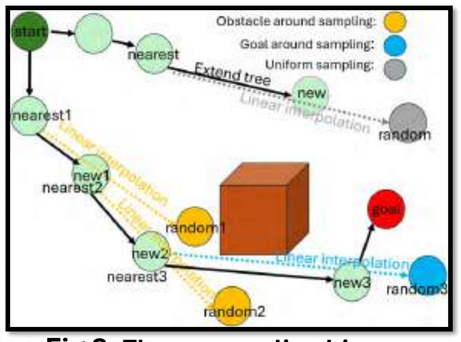


Fig 3: Three sampling biases are adaptively combined to ensure probabilistic completeness

Algorithm 1 Adaptive Sampling Path Planner

Require: $\mathbf{x}_{\text{start}}, \mathbf{x}_{\text{goal}}, \sigma, K_{\max}$
Ensure: $\mathcal{P}$ (path from start to goal) or $\emptyset$

$\mathcal{T} \leftarrow \text{InitializeTree}(\mathbf{x}_{\text{start}})$
$\mathcal{O} \leftarrow$ workspace,obstacles
for $k = 1$ to $K_{\max}$ **do**
  if $\text{rand}(0,1) < p_{\text{goal}}$ **then**
    $\mathbf{q}_{\text{target}} \leftarrow \text{GoalaroundSample}(\mathbf{x}_{\text{goal}}, margin)$
  else if $\text{rand}(0,1) < p_{\text{gaussian}}$ **then**
    $\mathbf{q}_{\text{target}} \leftarrow \text{GaussianSample}(\mathcal{O}, \sigma)$
  else
    $\mathbf{q}_{\text{target}} \leftarrow \text{UniformSample}(workspace)$
  end if
  $\mathbf{q}_{\text{near}} \leftarrow \text{NearestNeighbor}(\mathcal{T}, \mathbf{q}_{\text{target}})$
  $\mathbf{q}_{\text{new}} \leftarrow \text{Steer}(\mathbf{q}_{\text{near}}, \mathbf{q}_{\text{target}}, \delta)$
  if $\text{CollisionFree}(\mathbf{q}_{\text{near}}, \mathbf{q}_{\text{new}}, \mathcal{O})$ **then**
    $\mathcal{T}.\text{add}(\mathbf{q}_{\text{new}}, \mathbf{q}_{\text{near}})$
    if $\|\mathbf{q}_{\text{new}} - \mathbf{x}_{\text{goal}}\| < \epsilon$ **then**
      if $\text{CollisionFree}(\mathbf{q}_{\text{new}}, \mathbf{x}_{\text{goal}}, \mathcal{O})$ **then**
        return $\text{ReconstructPath}(\mathcal{T})$
      end if
    end if
  end if
end for
return $\emptyset$

Fig 4: Sampling method is selected randomly

Our method improves upon RRT-connect by adaptively combining three sampling strategies: 1)obstacle-proximal sampling to efficiently locate narrow passages, because way out is often around obstacles; 2)goal-biased sampling to accelerate convergence;3) uniform sampling to ensure completeness.

The algorithms were tested in a maze with narrow passages and cluttered regions. It highlights the new method's obstacle-focused and goal-directed sampling.

Verification is implemented on i5 125H (3.60 GHz) HP computer with 32.0 GB RAM against traditional RRT-connect method and executed 20 times on the same hardware platform and map for both methods.

Results and discussion

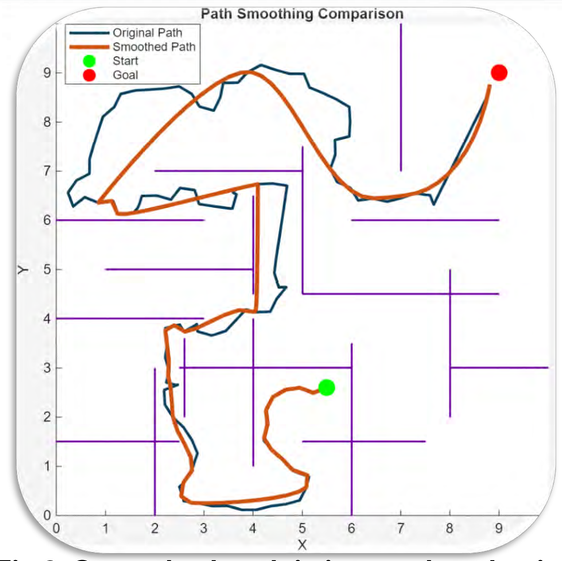


Fig 6: Smoothed path is interpolated using quadratic method

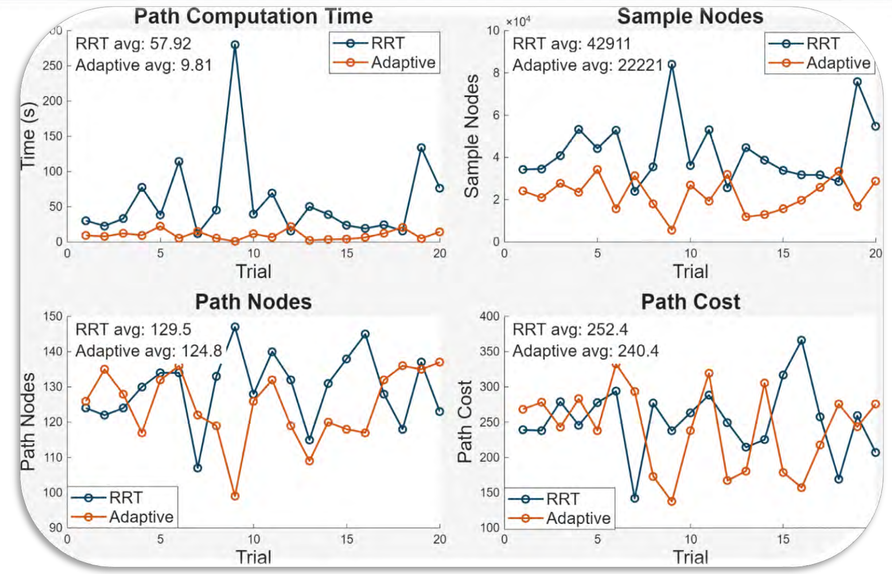


Fig 7: Two sharp peaks in the top plots indicate traditional method prolonged searching for a feasible path

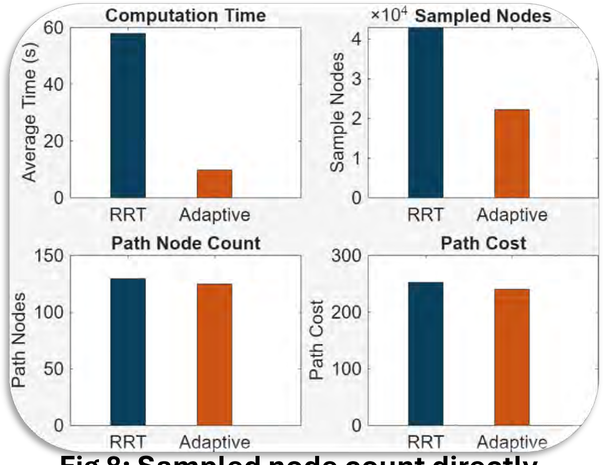


Fig 8: Sampled node count directly correlates with memory and computational cost, as each node is stored and queried during nearest-neighbor searches

The results demonstrate a 5.9× speedup in planning time (57.92s → 9.81s), 48% reduction in sampled nodes (42,911 → 22,221), and 5% improvement in path cost (252.4 → 240.4). These improvements strongly support the efficacy of our adaptive sampling approach. The performance gains primarily stem from obstacle-proximal sampling, which efficiently discovers narrow passages and reduces wasted exploration in open space. Meanwhile, goal-biased sampling directly shortens convergence time by focusing search effort toward the target region. The maintained uniform sampling ensures completeness, preventing stagnation and enabling the modest path quality improvement.

Conclusion

In summary, this research successfully developed an efficient path planner that directly addresses the performance limitations of traditional algorithms. Through targeted improvements in sampling strategy, the proposed method significantly reduces planning time, memory usage, and hardware requirements in 2D narrow passages environment. Future work will extend validation to 3D environment to further assess scalability and real-world applicability.

Acknowledgement

I am deeply grateful to my supervisor, Dr Ben Chang, for his expert guidance, continuous support, and insightful advice throughout this project.

Reference

Cheng, X. et al. An improved RRT-Connect path planning algorithm of robotic arm for automatic sampling of exhaust emission detection in industry 4.0. *J. Ind. Inf. Integr.* **33**