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University of Waikato Summer Research Programme

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

How are high court judges justifying reduced sentences for offenders who experienced adverse life circumstances?

Zahra Rennie, Dr Devon Polaschek & Dr Danica McGovern

Introduction

- When judges sentence for crimes, they can reduce sentences if they find the person's **decision to offend was compromised** by adverse life circumstances.
- Adverse life circumstances may include deprivation (e.g., poverty, abuse, poor education), historical dispossession (e.g., colonisation, cultural disconnect), and addiction.[1]
- Understanding how judges justify reduced sentences (particularly for contentious reasons like life circumstances) is important to ensure judges are making transparent, defendable decisions; a key part of a fair justice system.

Adverse life circumstances → Decision to offend compromised → Offending

Hypothetical pathway judges use to justify reduced sentences

Aim

Examine how judges justify reduced sentences for adverse life circumstances.

Method

1. Collected sample of high court judges' sentencing notes (n = 44).
2. Extracted judges' reasoning from sentencing notes when they gave reduced sentences (n =33).
3. Formed pathways based on judges' reasoning and identified patterns across pathways.

Simple pathway example:

Abusive childhood → Addiction → Offending

Vague pathway example:

Background → Offending

Complex pathway example:

Dysfunctional childhood, Learning disability, Being homeless young → Gang membership → Meeting co-offenders → Offending; Addiction → Offending

Results

- The **complexity** and **number of circumstances** in each judge's pathway **varied from case to case**.
- Two cases were too vague to know which adverse circumstances the judge was basing the reduced sentence on.
- Deprivation circumstances were most often included in the basis for reducing sentences (28/33), followed by addiction (10/33), and historical dispossession (6/33) and most circumstances first occurred during childhood.
- Though not explicitly discussed by judges, nearly all circumstances included in their pathways were described in a prior case as **comprising someone's decision to offend.**[1]
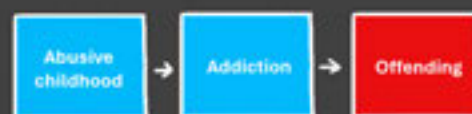
Discussion

Most sentencing decisions contained at least a simple version of the hypothetical pathway, providing transparency in their decision-making.

Next steps

Repeat the process with sentencing notes from district court judges to see whether the pathways to reduced sentences and types of circumstances considered are similar for lower severity offences.

References

[1] *Berkland v. R* [2022] NZSC 143, [2022] 1 NZLR 509.

Understanding home support needs of people aged 65+ years in the WBOP

In Aotearoa New Zealand the population of people aged 65+ is likely to grow from approximately 842,000 to 1.5 million by about 2050. (Stats NZ, 2022).

This research seeks to understand ways in which people aged 65+ years can be supported to continue living well in their own home.

This community based research project was developed in partnership with members from Age Concern Tauranga, Tauranga Rural Women, Grey Power Western Bay of Plenty and National Council of Women Tauranga who came together to form the Home Care Advocacy Group.

This group proposed that there were gaps in the current system that provides at-home care for those over the age of 65, and were passionate about finding ways to better support people to remain in their own homes as they age.

Summer Research Scholar: Molly Crawford

Principal Researchers: Dr. Kelly Glubb-Smith & Dr. Trish Hanlen

Conducted alongside the Home Care Advocacy Group

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References
Charmaz, K. (2017). Constructivist grounded theory. The Journal of Positive Psychology, 12(3), 299–300.
Stats NZ. (2022). One million people aged 65+ by 2028. https://www.stats.govt.nz/news/one-million-people-aged-65-by-2028

Two Part Qualitative Study ①

Stage One: Interviews

Semi-structured interviews with 19 people over the age of 65 that are currently living in their own homes.

Research aim: What informal and formal supports do people over the age of 65 years need to continue living in their own home and to avoid hospital level care?

Stage Two: Survey

Survey run through Qualtrics and sent to employee's of Care Service Providers and NASC (needs assessors) coordinators

Research aim: To improve innovation, policy development and the practice of service provision for older people living in their own home, to reduce the need for hospital level care.

Stage One: ②

Visual mapping of emerging categories

Memo Writing

Otter.ai

Emerging Themes

Constructivist Grounded Theory (Charmaz, 2017)

Reflexive team coding processes

Inductive and Deductive Approach

NVivo

Thematic Analysis

③

"The support is there, but it is difficult to access." – *Shannon*

"There's no roundabout at the bottom of the hill." – *Holly*

Participant's Voices

"I have a grave concern for a lot of older people, they seem to be isolated." – *Erina*

"The other option is he goes into care and I'm home on my own and I don't want that" – *Olivia*

Outcomes ④

Paid care works best when carers foster empathy and connection

Maintaining independence is paramount

Themes

Importance of support groups

Informal carers need care

Where to from here?
- First journal article from Stage One in process
- Stage Two results to be analysed
- Report from both stages to be published
- Advocating for changes to be made!

EXPLORING IDENTITY AT THE NEXUS OF FOOD, EATING, AND DISABILITY

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BACKGROUND

Food and eating form a nexus of self that reflects culture, class, and personal identity: food represents more than its biologically functional usage. In disability-related research, the literature predominantly focuses on the nutritional and mechanistic aspects of food and eating. However, there remains a significant gap in exploring the lived, phenomenological experiences of people with disabilities regarding food and eating, and how these experiences influence social, emotional and psychological identities [1].

RESEARCH AIM

To explore relevant existing literature, particularly studies that gives voice to the lived experiences of people with disabilities, to inform further research in Aotearoa concerning food, eating, and disability.
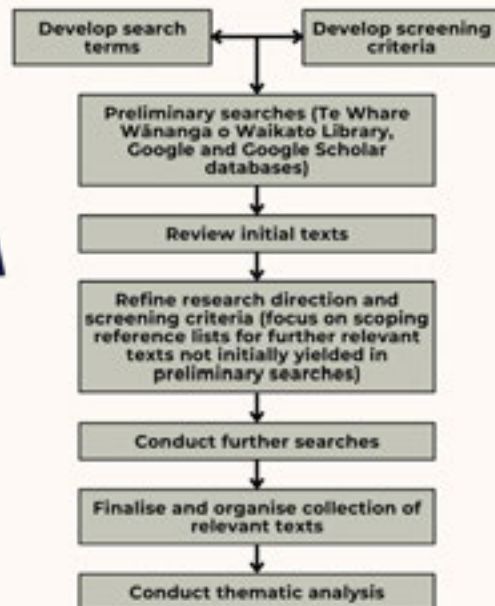
ACKNOWLEDGEMENTS

Research by Ana Mcleay. Thank you to Rebekah Graham and Bridgette Masters-Awatere for their supervision and support, and to the University of Waikato Summer Research Scholarship for facilitating this project.

References

1. Cipriano-Crespo, C., Conde-Caballero, D., Rivero Jiménez, B., & Mariano-Juárez, L. (2021). Eating Experiences and Quality of Life in Patients with Larynx Cancer in Spain. A Qualitative Study. International Journal of Qualitative Studies on Health and Well-Being, 16(1). https://doi.org/10.1080/17482631.2021.1967262

2. Concept map adapted from figure in Cipriano-Crespo, C., Rodríguez-Hernández, M., Cantero-Garlito, P., & Mariano-Juárez, L. (2020). Eating Experiences of People with Disabilities: A Qualitative Study in Spain. Healthcare (Switzerland), 8(4). https://doi.org/10.3390/healthcare8040512

METHOD

Develop search terms ↔ Develop screening criteria

↓

Preliminary searches (Te Whare Wānanga o Waikato Library, Google and Google Scholar databases)

↓

Review initial texts

↓

Refine research direction and screening criteria (focus on scoping reference lists for further relevant texts not initially yielded in preliminary searches)

↓

Conduct further searches

↓

Finalise and organise collection of relevant texts
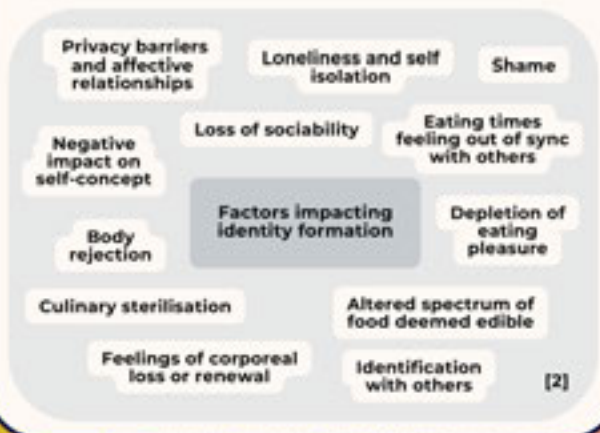
↓

Conduct thematic analysis

We utilised three categories of search terms (broadly covering food, culture and disability). Combinations of the categorical search terms formed a more comprehensive search scope e.g. (eat* OR food*) AND (disabilit* OR impair*).

OR	Food*	Identit*	Disabilit*
	Eat*	Culture*	Impair*
	Cook*	Self*	Neurodiverge*

AND

FINDINGS

Preliminary searches yielded a body of literature that was largely conducted in the fields of medicine, health sciences, and occupational therapy; in these texts, the voices of the participants were generally muted. Since most of these articles weren't relevant to our research direction, we focused our attention on reviewing pertinent texts and delved into a smaller pool of literature. Thematic analysis of this pool of literature revealed recurring experiential narratives among people with disabilities, and indicated that the significance of food and eating in identity formation for people with disabilities is often overlooked in academia.

Privacy barriers and affective relationships — Loneliness and self isolation — Shame

Negative impact on self-concept — Loss of sociability — Eating times feeling out of sync with others

Body rejection — **Factors impacting identity formation** — Depletion of eating pleasure

Culinary sterilisation — Altered spectrum of food deemed edible

Feelings of corporeal loss or renewal — Identification with others [2]

CONCLUSION

This research provides insight into how identity, food, and disability intersect. It lays the groundwork for future studies in Aotearoa focusing on the lived experiences of people with disabilities. These findings can inform more inclusive policies and practices.

Wellbeing of Family Harm Victims Based on Police Reporting

Danika Bridge & Dr Apriel Jolliffe Simpson

Background

- The New Zealand Crime and Victims Survey (NZCVS) found that 77% of offences committed by family members are not reported to police.[1]
- It is assumed in public policy that reporting to police leads to better outcomes for victims.[2]
- But it is unclear whether victims who report to police have better wellbeing outcomes compared with non-reporting victims.

Research question

- Are there differences in the wellbeing of family harm victims who report none, some, or all of the family harm offences they experience to police?

Method

Extracted NZCVS data for family harm victims (n = 1029)

Created groups describing proportion of offences victims reported to police
100% = All   0% = None
99.9-0.1% = Some

Compared mean scores on three wellbeing measures

Life satisfaction

p = .004   p = .002

M = 7.22
SD = 2.02

M = 6.64
SD = 2.48

M = 7.21
SD = 2.04

Psychological distress

p = .006   p < .001

M = 6.59
SD = 5.86

M = 8.66
SD = 6.01

M = 6.48
SD = 5.54

Feelings of safety

p = .004   p < .001

M = 7.31
SD = 2.30

M = 6.66
SD = 2.24

M = 7.68
SD = 1.93

All   Some   None

Note. All wellbeing measures were scored from 1 to 10.
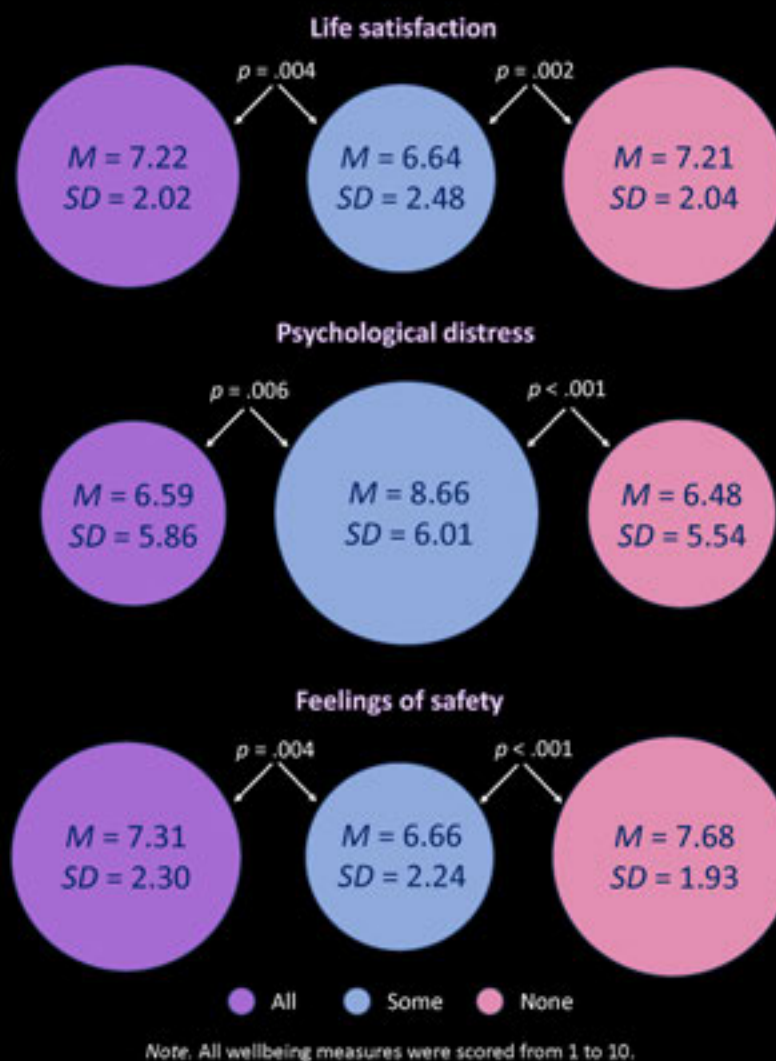
Results

- Regardless of demographic characteristics, most victims (60-77%) did not report any of the family harm offences they experienced to police.
- Around 14% of victims reported some offences and not others.
- The some group had lower life satisfaction and feelings of safety, and higher psychological distress, compared with the other groups.
- There were no significant differences in wellbeing measures between the all and none groups.

Next steps

- Further analyse the some group to identify potential confounding variables such as a difference in the total number of offences victims experienced, or perceived severity.
- Examine whether victims received support from avenues other than police (e.g., family, health and social services).
- Identify other wellbeing outcomes and information sources that can be analysed to explain the relationship between victim wellbeing and contact with police (or lack thereof).

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Te Puna Haumaru
New Zealand Institute for
Security and Crime Science

Reference
[1] Ministry of Justice. (2023). *New Zealand Crime and Victims Survey. Section 7 – Reporting to the Police.* June 2022. https://www.justice.govt.nz/assets/NZCVS-Cycle-4-Core-Report-Section-7-Reporting-to-the-Police-fin.pdf
[2] New Zealand Police. (2024). *Family Harm approach (with resources).* https://www.police.govt.nz/advice-services/family-violence/family-harm-approach-resources

Interpersonal Interaction in Online Discussion

Miaoxing Chen   Supervisors: Maria Galikowski, Liang (Kathy) Li, & Margaret Franken

Introduction

Background

Asynchronous online discussions (AOD) in tertiary education are believed to foster flexible participation, enable collaborative knowledge construction, and promote deep learning through thoughtful engagement. However, little is known about which linguistic devices are used for online interaction and how these might be effective in AOD.

Aim

The aim of this study is to explore the language used in different types of talk in AOD to enhance online interaction and knowledge construction.

Appraisal Framework

- The model employed in this study is Martin and White's (2005) appraisal framework, which refers to "an approach to exploring, describing and explaining the way language is used to evaluate, to adopt stances, to construct textual personas and to manage interpersonal positionings and relationships" (White, 2020).

- The appraisal framework has the following three components:

1. **Attitude** uncovers the emotional and evaluative layers of language;
2. **Engagement** provides the tools to presents and recognises different voices; and
3. **Graduation** indicates the degree of evaluation.

Methodology

We conducted a manual analysis of 96 posts contributed by 6 students in a level three university course in 2023, following these three stages:

1. we categorised online posts into three types of talk, which are independent talk (IT), cumulative talk (CT), and exploratory talk (ET);

2. we employed Martin and White's Appraisal Framework to manually annotate all the posts; and

3. we used AntConc for text processing and extracting sentence contexts to carry out both quantitative and qualitative analysis.

Types of Talk

Independent talk (IT)	Cumulative talk (CT)	Exploratory talk (ET)
IT refers to students expressing their individual perspectives, opinions, or information in the discussion with no attempt to respond to others (Delahunty, 2018).	CT builds on the interlocutor's previous contribution. It is uncritical with minimal divergence from the previous contribution and the emphasis is on constructing the relationship (Mercer, 2000).	ET places a greater emphasis on exploring new perspectives, fostering mutual understanding, and collaborative learning in the discussion. Students may pose questions, share viewpoints, and collectively work towards comprehending complex concepts (Mercer, 2000).

Findings

High-frequency appraisal devices of each talk type
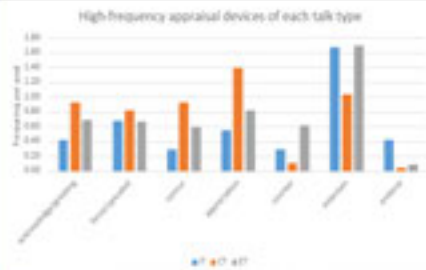
- In asynchronous discussion, IT is characterised by the frequent use of entertain and endorse devices, allowing participants to express their personal opinions and to reference external resources to support the opinions. At the same time, compared with CT and ET, IT exhibits limited engagement in interactions.

- CT and ET place different emphasis on communication. CT tends to align with the interlocutor, employing the most acknowledge, force, concur, and appreciation devices.

- ET also resorts to these devices but more notably, ET incorporates the most counter and entertain devices to engage in arguments with the interlocutor and introduce new contributions to the conversation. Mercer (2000) suggests ET is likely to be the most effective type of communication for knowledge construction.

High-Frequency Patterns of Each Talk Type

Three common patterns were employed by the online participants during their interactions.

Independent talk (IT)	Examples	Cumulative talk (CT)	Examples	Exploratory talk (ET)	Examples
Entertain (Personal opinions) +	I think…	Acknowledge (Greeting) +	Hi, xxx (name)	Acknowledge (greeting) +	Hi, xxx (name)
Entertain (Rhetorical questions)	What do you think about…?/ How do you think about…?/ I invite you to discuss more about…	Force (Upscaled) +	very/really	Concur +	agree with your opinion
		Concur +	agree with you	Counter +	but
		Appreciation +	Your answer is good/interesting	Entertain (Personal opinions) +	I think…
		Repetition of content +	paraphrase or summarise your interlocutor's talk	Entertain (Rhetorical questions)	What do you think about…?/ How do you think about…?
		Entertain (Rhetorical questions)	What do you think about…?/ How do you think about…?		

Conclusion and Implications

- When expressing ideas online, it is advisable to employ entertain devices to hedge opinions and endorse devices to convince the interlocutors.

- When interacting with other participants, the skilful use of acknowledge, upscaled force, concur, and appreciation devices could foster a positive relationship. However, the use of counter devices is the key strategy for introducing new knowledge contributions.

- The findings of this study together with the linguistic items can be introduced to online participants through activities such as role play to facilitate their interactions. Future research could delve into the impact of these linguistic strategies on interlocutors, exploring whether specific strategies contribute to a more positive and engaged response.

References

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Martin, J. R., & White, P. R. R. (2005). *The language of evaluation: Appraisal in English*. Basingstoke, England: Palgrave Macmillan.

Mercer, N. (2000). *Words and minds: How we use language to think together* (1 ed.). Routledge. https://doi.org/10.4324/9780203464984

White. (2020, January 1). *The language of attitude, arguability and interpersonal positioning: The appraisal website*. https://www.grammatics.com/appraisal/

VOICES OF PARLIAMENT

Serrano Lorenz
Joe Ulatowski & Andreea Calude

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Introduction

Political discourse plays a crucial role in shaping public policies, particularly in addressing important healthcare issues such as cancer. However, there is a lack of research examining the specific speech-acts[1] [2] employed by New Zealand politicians when discussing cancer-related[3] issues. Utilising the Hansard[4] scripts to construct a corpus, we investigated the speech-acts used within the political discourse on cancer.

Research Aim

Our aim is to identify and analyse prevalent speech-act types in the Hansard debates, such as directives or expressives, to see any distinct patterns in how New Zealand politicians communicate about cancer.

Method

- Collected days in Hansard debates between 2011-2017 containing relevant mentions of 'cancer'
- Created corpus containing 3,227,332 words from 67 files with 524 relevant mentions of cancer in 218 sentences.
- Analysed full data set using AntConc corpus linguistic software to analyse context and key verbs.
- Manually coded each sentence containing cancer into speech-act types: assertives, commissives, directives, or expressives.
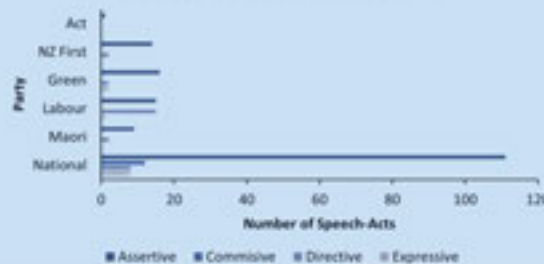
Further Research

Future research could delve into the temporal evolution of cancer discourse in New Zealand parliamentary sessions, employing corpus analysis techniques to trace shifting speech-acts and rhetorical strategies employed by politicians. An in-depth analysis over multiple parliamentary sessions would provide valuable insights into the dynamic linguistic strategies of the evolving narratives surrounding cancer-related policies and discussions.

SPEECH-ACTS BY PARTY

Party: Act, NZ First, Green, Labour, Maori, National
Number of Speech-Acts: 0, 20, 40, 60, 80, 100, 120

■ Assertive ■ Commisive ■ Directive ■ Expressive

[1] Austin, J. L. (1962). *How to do things with words.* Oxford: Clarendon Press.
[2] Searle, J. R. (1975). *A taxonomy of illocutionary acts.*
[3] Plutynski, A. (2019). *Cancer.* Stanford Encyclopedia of Philosophy.
[4] Hansard. (2011-2017). *Hansard (Debates).* New Zealand Parliament Pāremata Aotearoa.

GREEN ROOFS IN ACTION
POLICY IMPLEMENTATION RESEARCH

INTRODUCTION

Amidst the rising temperatures and declining green space, municipalities such as Tauranga City Council must consistently provide adaptive and innovative solutions to meet the evolving needs of their communities.

Green roofs are increasingly recognised as sustainable solutions for cities worldwide (1). They are characterised as vegetated rooftops, able to provide benefits including insulation, stormwater management, and air pollution mitigation (2).

This project focuses on a review of academic research and international green roof policies to enhance understanding of effective policy levers for Tauranga City Council.

FINDINGS

The primary barriers in green roof implementation are;
Financial investment
Lack of knowledge
Insufficient policy incentives

Existing international policy comes under;
Planning and Development
Financial Incentives
Non-Financial Incentives
Mandatory Regulations
Public Awareness and Outreach

CONCLUSIONS

Effective policy and planning are essential for the successful distribution of green roofs.

Prioritising education and research is a foundational step to ensure comprehensive understanding and support toward green roof implementation.

Municipalities have overcome barriers through strategic engagement and policy writing.

The synthesis of academic literature and current policies provides Tauranga City with valuable exemplars that can be utilised as references for the potential development of their own policies.

METHODS

IDENTIFIED LITERATURE
Used Scopus database searching to identify literature on green roof policy, implementation, and strategy.

SINTHESISED RESEARCH
Reviewed academic research for green roof benefits, policies, barriers, and lessons.

ANALYSED EXISTING POLICY
Gathered a sample of accessable international green roof policy to compare within categories .

INTERVIEWED GREENROOFS NZ
Discussed wider green roof potential in Aotearoa with director of GreenRoofs NZ.

REFERENCES

(1) Al-Zu bi, Maha, and Osama Mansour. 2017. "Water, Energy, and Rooftops: Integrating Green Roof Systems into Building Policies in the Arab Region." Environment and Natural Resources Research 7 (2): 11–36. https://doi.org/10.5539/enrr.v7n2p11.

(2) Clar, Christoph, and Reinhard Steurer. 2021. "Climate Change Adaptation with Green Roofs: Instrument Choice and Facilitating Factors in Urban Areas." Journal of Urban Affairs, March, 1–18. https://doi.org/10.1080/07352166.2021.1877552.

LORENA KUCEHNBECKER, DR. XINYU FU, & STÉPHANIE KELLER-BUSQUE

Tauranga City

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A positively imagined future leaves a positive past in its wake

Lily McDonald & Dr Aleea Devitt

Background

- In everyday life we often imagine future events that will actually happen[1] E.g. You might imagine a job interview going well.

- When people imagine a future event positively, they go on to remember the actual event more positively overall. This *positivity bias* happens even when the actual event felt neutral at the time[2].

- But, we don't know what causes this positivity bias. We examine this question in two studies.

Study 1

In prior studies, participants imagined positive and negative events. They then read stories describing overlapping events, that crucially were neutral in tone. Finally, they completed a memory test for the stories, before rating the emotion of the stories[2,3].

- The memory test included both details that were in the story and details that weren't in the story (a form of *misinformation*.)[4]

- Misinformation presented after an event is sometimes incorporated into people's memories for those events[4].

- We hypothesise that participants incorporate misinformation from the memory test into their memories for the stories they read, and this results in the positivity bias in their ratings.

> To what extent are people influenced by a memory test when they rate story emotion?
>
> To answer this question:
>
> We adapted previous methods by making one key change: half the participants rate emotion before the recognition test, and half after.

Method

- To answer our research question, we adopted the method from prior experiments, but with one key change.

- Half of the subjects rated the emotion of the story from 1 = negative, to 7 = positive before the memory test, and half rated the emotion after.

Phase 1:

Imagine positive or negative events.

→

Phase 2:

Read neutral stories about how imagined *and* non imagined events played out.

OR

Phase 3:

| Memory test for story details | → | Rate emotion of story details |

| Rate emotion of story details | → | Memory test for story details |

Mean Emotion Ratings by Imagination Type

■ Ratings first ■ Ratings second

Error bars represent 1 standard deviation

We replicated the positivity bias:
people who imagined a positive future event went on to remember that event more positively
but
this positivity bias did not change depending on whether subjects did the memory test or the emotion ratings first.

Results

- The emotion of imagined future events in Phase 1 effected people's subsequent rating of story emotion during Phase 3 ($F_{(2,270)} = 4.80$, $p = 0.01$). Positive imagination led to more positive emotion ratings for the stories than negative imagination (95% CI [0.11,0.91], $p = 0.01$).

- The order of rating and memory test had no effect on emotion ratings ($F_{(1,270)} = 4.799$, $p = > .05$).

Discussion

- Our findings do not support the idea that the positivity bias occurs as a result of misinformation in the memory test.

- Instead, this bias might occur because positive thinking is more general than negative or neutral thinking.[2] We explore this possibility in Study 2.

Study 2
(Data collection ongoing)

- When we remember something, we must use the detail of the memory to decide where it came from (e.g., if it came from the outside world or our own thoughts).[5]

- When participants rate emotion in Phase 3, they must decide whether the feeling that comes to mind is from the story or their imagined event.

- We know that positive thinking encourages a more general outlook,[2] which means there is *less detail* available to decide where a positive memory came from. We also know that imagining an event more times makes it *more detailed.*[6]

- Therefore, we hypothesize that the positivity bias in participants' emotion ratings is the result of decreased detail available in positive memories to determine where a that memory came from.

> To what extent does the level of detail in an imagined future affect the positivity bias for that event after it happens?
>
> To answer this question:
>
> We adapted previous methods by making one key change: Participants imagined some events once and some events twice.

References:
1. D'Argembeau, A., Renaud, O., & Van der Linden, M. (2011). Frequency, characteristics and functions of future-oriented thoughts in daily life. *Applied Cognitive Psychology*, 25(1), 96-103.
2. Devitt, A. L., & Schacter, D. L. (2018). An optimistic outlook creates a rosy past: The impact of episodic simulation on subsequent memory. *Psychological Science*, 29(6), 936-946.
3. Devitt, A. L., & Schacter, D. L. (2020). Looking on the bright side: Aging and the impact of emotional future simulation on subsequent memory. *The Journals of Gerontology: Series B*, 75(9), 1831-1840.
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6. Goff, L. M., & Roediger, H. L. (1998). Imagination inflation for action events: Repeated imaginings lead to illusory recollections. *Memory & Cognition*, 26, 20-33.

TRANSFORMING MINDS: INDIGENOUS KNOWLEDGE, EPISTEMOLOGICAL DOMINANCE, AND COGNITIVE FLEXIBILITY

Integrating Indigenous knowledge further into mainstream discourse

Lita McGrath, supervised by Dr Justine Kingsbury and Dr Gemma Piercy-Cameron

Te Kura Aronui - School of Social Sciences

THE UNIVERSITY OF WAIKATO

Research motivations

We are three white women investigating ways to decolonise higher education, challenge power structures, and knowledge as having one universal truth. We seek to convey the significance of Indigenous spiritual knowledge to anyone whose thinking is framed by a singular epistemology.

The Project

Indigenous spiritual knowledge challenges western epistemologies, raising questions, including: how can spiritual knowledge be valued from a scientific mindset? Associating Indigenous knowledge with practical application challenges rigid mindsets, and sharing knowledge about knowledges assists in building cognitive flexibility.

Scan for References

Framework

Associating knowledge with its potential for practical intervention makes spiritual knowledge more accessible to outsiders and promotes the exploration of diverse knowledge systems. Knowledge about knowledges argues for the prioritisation of practical knowledge value rather than perceiving knowledge as a reflection of truth. This eases the psychological threat of a different worldview.

Outcomes

Teaching knowledge as intervention, and knowledge about knowledges makes Indigenous knowledge more visible/valuable to outsiders, promoting cognitive flexibility and acting as a stepping stone towards decolonising classrooms.

Indigenous Interventions	Western Interventions
Subak: Asia's effective water irrigation systems rooted in Balinese-Hinduism ensures successful rice production	During the 1960s, replacing Subak with scientific irrigation resulted in a 50% drop in rice production. Subak was therefore reintroduced
In te ao Māori, Taniwha are guardians. In Matatā the swishing tail of Taniwha indicates flood-risk, allowing Māori to select safe Marae sites	In 2005, Matatā faced floods damaging many buildings, yet the four Marae endured. Taniwha factored into urban planning could prevent flood damage
Aboriginal cool burning controls bushfires through lighting and monitoring low fires, managing dry underbush and protecting flora and animal habitats	2019/2020 bushfires devastated Australia. Implementing cool burning into policy could prevent future bushfires

Updating the Systematic Evidence Map on Disparities in Police Outcomes

Charlotte Ward, Dr Lisa Tompson, Dr Andrea Taylor, Bridget O'Keeffe

Te Puna Haumaru
New Zealand Institute for Security and Crime Science
THE UNIVERSITY OF WAIKATO

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Research Question

"What is known about the nature and impact of possible bias in policing strategies and practices internationally?"

Background

Scan Me!

In 2021 an evidence and gap map was created to address the research question. The previous research team identified 403 studies ranging from 2000-2018 that were eligible for inclusion on the map.

Evidence and gap maps are designed to provide a visual representation of research in a chosen field. The map displays the studies within a matrix, defined by two key axes:

- Police Actions: i.e. stops, searches, use of force
- Dimensions of Bias: i.e. race, gender and age

Studies are placed on the map according to their research methodologies. The map also allows users to delve into specific areas of interest and access individual studies. This layout allows for quick and intuitive understanding around which areas have been extensively researched, and where knowledge gaps may exist.

Aim

To update the evidence and gap map with eligible studies published from 2019 onwards.

Police Actions

- Investigation
- Acting on Suspicion
- Other
- Professional Conduct
- Deployment
- Charging Decisions

Dimensions of Bias

- Structural
- Institutional
- Ecological
- Individual
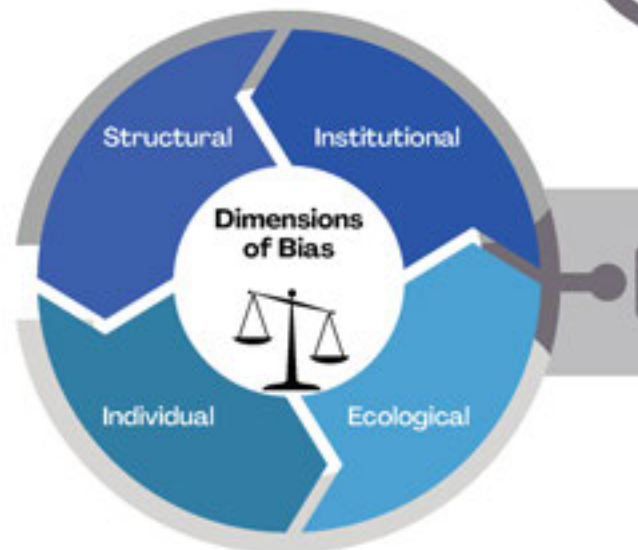
Method

Systematic research methods were used to qualify new studies. This method uses a set protocol for data collection, detailed analysis and a strong emphasis on reducing biases and ensuring replicability.

- Using data obtained from the Global Policing Database, we screened the studies against the eligibility criteria
- Conducted citation analyses to locate further studies for inclusion
- Located PDF copies of full studies in preparation for next steps

Outcomes

Of the **2995** studies screened:

- **1** Not in English
- **2** Too Little Information
- **1710** Not on Police
- **988** No Focus on Disparities in Police Outcomes
- **74** Not Empirical Research
- **6** Source of Potential Studies
- **216** Include Based on Study Title & Abstract

Next Steps

- Full Text Screening: entire study to be screened against eligibility criteria
- Data Extraction: extracting key data from full text for map

References:
Tompson, L. et al (2022). Systematic evidence map of disparities in police outcomes: Dataset. Hamilton, New Zealand: University of Waikato

Understanding Types of Polyvictimisation

Donelle Steer & Dr Apriel Jolliffe Simpson

BACKGROUND

- A small proportion of the population experiences a majority of crime, with many of these people experiencing multiple crime types (e.g., assault and theft). [1]
- People who experience multiple crime types are known as polyvictims. [2]
- But it is not yet clear whether there are combinations of crime types that polyvictims commonly experience (e.g., assault and theft vs. cybercrime and fraud).

RESEARCH QUESTION

- Can we identify meaningful groups of polyvictims based on the types of crime they experience?

METHOD

- Identified polyvictims in the New Zealand Crime and Victims Survey (N = 5037).
- Used latent class analysis to answer the research question. [3]

Class 1 (n = 135)

Class 2 (n = 2466)

Class 3 (n = 2439)
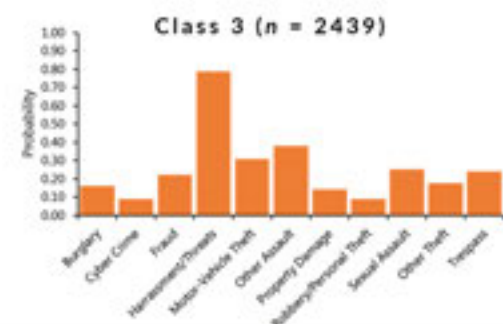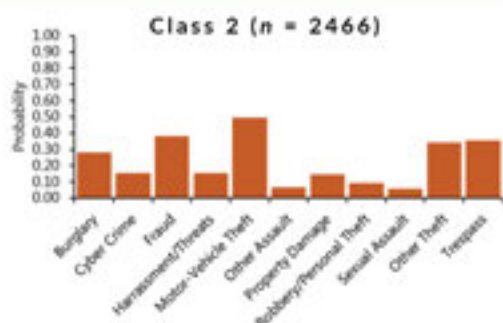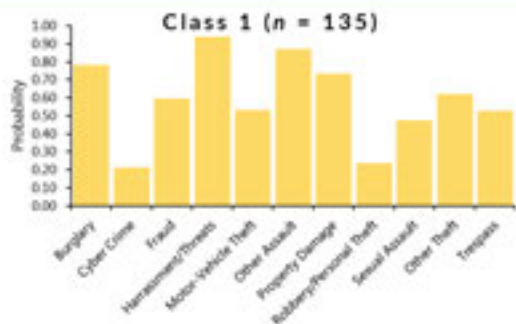
RESULTS

- Class 1 had the highest probability of experiencing all crime types.
- Class 2 had a moderate probability of vehicle theft, fraud, trespass, and theft.
- Class 3 had a high probability of harassment/threats and a moderate probability of vehicle theft and assault.
- Compared with other classes, class 1 included more women and Māori, people experiencing moderate or high psychological distress, and financial stress, living in urban areas.
- Classes 2 and 3 had similar characteristics.

NEXT STEPS

- Further analyses to learn why polyvictims commonly experience certain combinations of crime types.
- Identifying demographic characteristics associated with increased risk of experiencing different types of polyvictimisaiton.

Te Puna Haumaru
New Zealand Institute for
Security and Crime Science
THE UNIVERSITY OF WAIKATO

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Background

Increasingly, households who seek rental accommodation turn to online rental listings to find a home. In Aotearoa, TradeMe is one of the most popular sites for listing and for finding rental properties.

Problem

Researchers have argued that online rental advertising can have a "democratising effect" because it expands homeseekers' search areas without increasing the costs of searching for a home. On the other hand, it can also reproduce existing housing inequalities by channelling population groups into or away from particular areas through various mechanisms, such as differences in the amount, quality or kind of information provided or by explicitly specifying tenant characteristics.

Aim

This study sought to examine to what extent online rental advertisements in Aotearoa play a role in reproducing classed and racialised housing inequalities. That is, how do landlords and property managers express tenant selection criteria in online rental listings?

PERFECT PLACE TO CALL HOME! ... BUT FOR WHOM?

Methods

We analysed the text of 242 online rental listings on TradeMe across 7 neighbourhoods in Christchurch, Hamilton and Auckland. These areas were selected based on their ranking in the housing deprivation index, with some ranking low and others high.

Results

Our analysis shows several notable patterns in online rental listings that may reproduce housing inequalities in Aotearoa:

- Listings commonly specify a low number of maximum tenants that was not commensurate with number of bedrooms, which encourages smaller nuclear families to apply.
- 117 of the listings (48%) specify an 'ideal tenant' using the box TradeMe provides and/or in the property description text. Most commonly, the ideal tenant was described as "professional" or as "clean and tidy".
- Listings in areas with high housing deprivation are more likely to catalogue only essential services, whereas those in more affluent areas foreground leisure and lifestyle amenities in the neighbourhood.
- Listings in affluent neighborhoods were also more likely to employ emotive language to describe the property and area as, for instance, "stunning", "charming" or "cute". By contrast, listings in more deprived areas use basic and neutral language to describe properties and neighbourhoods.

Conclusion

Our findings suggest that online rental listings contribute to exisiting housing inequalities through often subtle but impactful linguistic strategies which are used to attract or deter particular households. Seeking out professionals or excluding larger families, for instance, can shape the opportunities of homeseekers on the basis of class and race/ethnicity. As a next step, we will take these findings into interviews with rental property managers to further discuss how tenant selection processes shape households' access to the Private Rental Sector in Aotearoa New Zealand.

Te Kura Toi Tangata- Division of Education

Young Citizens

Exploring Opportunities for Citizenship Education in the Refreshed Te Ao Tangata Social Sciences Curriculum

Te Mātaiaho
THE REFRESHED NEW ZEALAND CURRICULUM

The learning areas of Mātaiaho
Te ao tangata | Social sciences
Including Aotearoa New Zealand's histories

Introduction

The aim for this project was to explore opportunities for educating active and critical citizens within the refreshed Te Ao Tangata Social Sciences curriculum introduced in Aotearoa New Zealand in 2023.

Questions

1. What type of citizen does the refreshed Te Ao Tangata Curriculum support young people to become?
2. How are young people encouraged to take up citizenship activities?

Methods

We first used reflexive thematic analysis to analyse the overarching themes of both past (NZC, 2007) and present (Te Mataiaho, 2023) social science curricula of Aotearoa New Zealand. We then applied citizen frameworks including Westheimer & Kahne's (2004) framework of three citizens to analyse what type of citizens our past and present social science curriculums are encouraging. Finally, we ran a number of text searches. All data analysis was conducted using the NVivo software.

Theme 1

Action Language

The refreshed curriculum has moved away from transmissional language expressed through operators such as 'Understand how' that permeated the Achievement Objectives of the 2007 curriculum to more clear action based language in Te ao Tangata 2023.

construct adapt
develop consider ask communicate
explore analyse define
identify generate
state
describe collect use
process engage

Theme 2

Justice-Oriented Citizens

Westheimer & Kahne's (2004) Framework: Three Kinds of Citizens

Our application of this citizen framework has shown an encouraging increase in 'justice-oriented' citizens in the refreshed curriculum who critically assess social issues and explore their root causes. The following figures show Westheimer and Kahne's three types of citizens and their occurance in both curriculums.

Personally Responsible (PR)
- Obeys laws
- Acts responsibly
- Works and pays taxes
- Volunteers/lends a hand

Participatory (PC)
- Active community members
- Organises community efforts
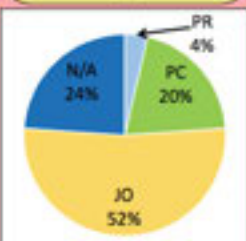- knows how government works and participates in political processes

Justice-Oriented (JO)
- Critically assesses social, political, and economic structures
- seeks out and addresses ares of injustice
- explores root causes of societal issues

NZC 2007
- PR 4%
- PC 27%
- N/A 57%
- JO 12%
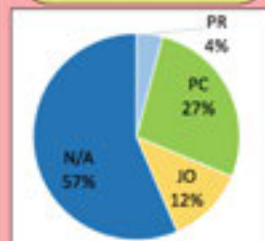
Te ao Tangata 2023
- PR 4%
- PC 20%
- N/A 24%
- JO 52%

Theme 3

No need to get political?

Both the 2007 and 2023 social science curricula use little political language. If you follow the black arrow to the NVivo Text Search data you will see that in the Te ao Tangata curriculum (2023), the words 'political' and 'democracy' had little to no mentions whereas the world 'values' was mentioned 35 times.

While political discussion can be difficult to navigate, understanding and being critical of our political systems is imperative to making change in our society.

Theme 4

What do you mean, social action?

In the refreshed curriculum, the term 'social action' is repeatedly used in the 'Do' section of each learning progression. This is a new term that was hardly used or explained in the 2007 curriculum and we it appears unclear as to what this social action would look like in practice.

Te tātori whakatau me te whakahaere mahi koringa pāpori | Analysing decisions and taking social action

This is an excert from Te ao Tangata (2023, p.7), as an example of the context it is used in.

Social action is mentioned **113** times in Te ao Tangata (2023)

Nvivo Text Search

Political: 4 references

Democracy: 0 references

Values: 35 refences

References

Scan me!

Implications:

1. Based on our findings, we recommend for the Ministry of Education to create a supporting document to explain social action further and provide examples of what this could look like across different stages of learning.
2. The lack of political/democratic references in the refreshed Te ao Tangata curriculum is concerning. To bridge this gap we intend to produce additional guidance to help teachers find oppurtunities within Te ao Tangata (2023) to teach young people to be political and engage as active and critical citizens in times of 'intersecting crises including insecurity and climate change' (Moore et al., 2021).
3. In comparison to the 2007 social sciences curriculum, the refreshed curriculum is clearer about the contexts in which conceptual learning takes place. Te Poutāhū has great video resources (see references) that can spark inspiration for teaching concepts over different contexts relevant to our tamariki at different stages of learning.

Poster by Danika Houghton
Supervised by Janina Suppers

WAIKATO

Diversity in university homepage imaging: Who is (in)visible?

Emma Jones - BMus student
Supervisor: Katrina McChesney
Wider research team: Shannon Mason (Nagasaki University, Japan) and Kate Rhodes (University of Waikato)

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Introduction

Hinojosa and Caul Kittilson's (2020) visibility cue theory of representation suggests that minoritised groups must be visible to encourage others to enter spaces like tertiary institutions. Universities have been working on becoming more diverse but not all characteristics of diversity are celebrated equally.

The way universities present themselves publicly to the world are deliberate marketing choices. This makes it reasonable to analyse these representations in this study to uncover how and where universities do and do not display diversity through the images displayed on their website homepages.

Method

Collected all images off the homepages from 16 Australian & New Zealand university websites over 2023/24

Manually coded data set which was analysed for: no. of people, visible faces, genders, ethnicities, ages, religion, disabilities, & parents

We acknowledge that we can only make inferences on visible outward appearances and that people have complex identities & experiences that can't be visible

Results & Findings

♿ **99.25% able-bodied**

✝ **1.15% religious**

👪 **0.77% parents**

Age	Young Adult	Middle-aged	Older Adult
Ethnicity	Caucasian	Indigenous	Asian / Mixed/Other
Gender	Female	Male	Other/Non-Binary

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

Conclusion & Discussion

Overall, diversity was visualised in approximately half of the categories. This suggests that there are equity issues in the way universities represent and market themselves to the world.

- AUS was better at representing gender and ethnicity as their results were not as varied as NZ universities.
- NZ was slightly better at representing the different age categories than AUS universities

The following are the universities with the most diversity:

- The University of Queensland (except religion & gender)
- The University of Waikato (except for parents) and visualised Indigenous people 2x more than Caucasians

The results from this analysis could be compared to the proportions of diversity in the universities' populations to consider whether they are representing their own level of diversity or using the visibility cue theory to display the diversity they want to encourage. Future research could compare the data of staff to student diversity rates and could also consist of analysing: body sizes, heights and the individual roles of the people in the universities' homepage images.

Acknowledgements

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

References

- Hinojosa, M, & Caul Kittilson, M. (2020). *Seeing women, strengthening democracy: How women in politics foster connected citizens.* Oxford Academic.
- AI Image generated using Runway from individualised prompts for each person.

Exploring the impact of English Curriculum change on Australian and New Zealand teachers

Emma Page, Dr Emma Cunningham, and Dr Leanne Fray

BACKGROUND | AIMS

Both Australia and New Zealand have undergone refreshes in their English curriculum, with Australia being the most recent in 2023. New Zealand is three years into a six year refresh of The New Zealand Curriculum. Te Maataiaho/the refreshed curriculum incorporates a framework of whakapapa, ensuring the new curriculum is coherent, inclusive, easy to use, and respectful of Te Tiriti O Waitangi. The refreshed English content will be mandatory in New Zealand from the start of 2025 (Ministry of Education, 2024).

This is a comparative study which explores the experiences of Australian and New Zealand teachers whilst engaging in English curriculum refreshes. This research aims to discover how supported teachers feel during the curriculum refresh rollout process, and how they feel the English refresh will impact on teaching and on student learning.

METHODS

Online Qualtrix surveys were conducted with 56 teacher participants from Australia (33) and New Zealand (23) that investigated three key research questions.
Five interviews so far have been undertaken in person or via Zoom with New Zealand teachers.

RESEARCH QUESTIONS

Q1. To what extent do teachers feel informed about the process of change?
Q2. How do teachers feel the new English curriculum will impact on student learning?
Q3. How do teachers feel the new English curriculum will impact teaching and learning?

SURVEY FINDINGS
(Australia and New Zealand)

- 53% of teachers felt that they were not regularly informed on the changes to the curriculum.
- 40% felt the communication between teachers and school leaders about the changes was unclear.
- 70% felt the communication between the Government/Ministry of Education and teachers about the changes was not good.
- 60% of teachers and school leaders did not feel they have been significantly consulted about the changes.
- 86% of teachers felt motivated and confident in their skills in teaching literacy.

INTERVIEW FINDINGS
(New Zealand)

- Most teachers felt a lack of information around implementation has led them to feel confused and unsupported.
- The majority felt communication was lacking between the Ministry of Education and school leadership, and between leadership and the teaching team.
- Most teachers had unanswered questions around how assessment will be structured with the new condensed progressions.
- Many teachers noted that trying to learn a new curriculum whilst teaching it will result in heightened stress levels.
- Most teachers felt the new structured literacy programme would not engage their students.

CONCLUSION

- The majority of participants from both countries did not feel that there was adequate communication from management or Ministry of Education on the requirements for the change or the details of the refresh.
- Many participants were concerned that tracking student learning through assessment will become harder with the new condensed progressions.
- Almost all participants feel confident teaching literacy, but the new content has the majority expecting a stressful change period, and low student engagement in structured literacy.

EARLY RECOMMENDATIONS

- An increase in communication from the Ministry of Education to the schools through school management related to the specific requirements involved in implementing the changes required.
- The ability for more negotiation and input on the changes from teachers. Kirk and MacDonald (2001) agree that significant teacher contribution during curriculum change is beneficial throughout the process.
- Content assistance and continued support should be made available to ensure classroom teachers are confident with the new curriculum before it is implemented.

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Ministry of Education. (2024). Te Maataiaho | The refreshed NZ Curriculum.

Online Safety in Education: Aotearoa New Zealand

Introduction

Computer and web technology is ubiquitous and pervasive in children's lives. cyber safety is of utmost importance for children to safeguard them from cyber harms, such as sextortion, cyberbullying, fishing, privacy theft, and online abuse [1]. To provide safe and better learning opportunities for learning, stakeholders, such as schools, organisations, government, teachers, and parents need to take appropriate actions. Online Safety is a big problem nowadays. However, there is a dearth of research that explores how online safety and online safety education are addressed in New Zealand

Aim: This research aims to examine the current situation of online safety in Aotearoa and what are the key solutions that schools are implementing.

Literature Review

Harmful Digital Communication (NetSafe 2018)[2]

- Cyberbullying 25%
- Online abused 17%
- Innappropriate content 27%
- Upset online 36%

- **Harmful Digital Communication** is defined as contact and content harm, such as cyberbullying, sextortion, online abuse, and threatening [3][4].
- **Online Safety** is defined as the awareness of online risks and participating in the digital world safely.[5][6]
- International studies have been increasingly concerned about online safety and are advocating for the use of educational awareness programmes.[7]
- Various reports about children's online footprint indicate concern regarding their safety and solutions. [8]

Interviews

- With students, it came out that students have good technology knowledge, but not about online safety.

- Teachers have superficial knowledge about online safety, and there is a need for more professional development training for online safety competency.

- With representatives of online safety providers, there is an urgent need to develop guidelines and policies to provide a safe learning environment.

- Schools were expected to provide a safe online environment, however, security is preferred over safety.

Methodology

- We used multiple sources to collect our data, such as
- Systematic literature review,
- Interviews with the organisations involved in cyber-safety (NetSafe, Linewize, etc.), teachers, students, focus groups,
- Previous 15 years of news database of The Stuff, RNZ, and NZ Herald.
- Coding was done using NVIVO Software and MS Excel.
- We used qualitative analysis.

Media Reports Analysis

- ❏ There has been an increase in online harm reporting, since 2020.
- ❏ Private Organisations, such as NetSafe, OurKidsOnline, and Citzen21, are actively taking part in promoting Online Safety.
- ❏ Introduction of the Harmful Digital Communication Act 2015 was a key step toward protecting against online harm.

Policy Analysis

- Two main policies that provide a framework and guidelines on online safety against online harm in **New Zealand-**
- ❏ Digital Harmful Communication Act 2015. [4]

- ❏ DIGITAL TECHNOLOGY Safe and responsible use in schools [9]

Organisations Dealing with Cyber-safety

CyberSmarties · netsafe · N4L · grok academy · Our Kids Online · Linewize

Findings

- ❏ Students were aware of online risks but didn't perceive schools' efforts to address online safety as very effective.
- ❏ Teachers were putting safeguarding measures in place for the sake of students' online safety but felt that there was not much more they could do about it.
- ❏ Private organisations are providing online safety solutions for schools, often promoting safeguarding measures that do not consider students' privacy and participatory rights
- ❏ Schools are promoting online safety at the individual level as well as taking the help of external providers, such as NetSafe
- ❏ More research is needed in the field of effective online safety educational material.
- ❏ Parents, teachers, government, external safety providers, and IT Companies should work hand in hand to provide online safety for kids.

(Scan QR for Reference and more details)

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How a Marae-based Conservation Program Impacts Beginning Teachers

Leigh-ana Hale, Supervised by Chris Eames and Janina Suppers

1. Introduction

Pre-service teachers studying at the University of Waikato are annually selected to attend '*Kiwi Forever*'- a marae-based conservation program for senior secondary students in the Ruapehu region. The pre-service teachers mentor the school students as they engage in te ao Māori and environmental education. Our study explored the impact of this program on the teachers' future practice. We hope our findings will support the implementation of future conservation programs and encourage pre-service teachers to seek out professional development in environmental education.

Key Question

What has been the impact of an iwi-based conservation program on pre-service teachers' future practice?

2. Methodology

We conducted 14 semi-structured interviews through video-conferencing. Nine of these interviewees were former pre-service teachers who attended the *Kiwi Forever* program, and the remaining five were program leaders. The interviews focussed on each participant's perspective of the program's actual (pre-service teachers) and desired (leaders) impact on the pre-service teacher's future practice. The interviews were transcribed, coded and thematically analysed through *NVivo* to identify key themes of impact.

3. Findings

THEME 1 Enhanced appreciation of te ao Māori (Straker, 2022)

"That was more than I'd learned in my entire life" (Isobelle)

5 of the 9 pre-service teachers directly included te ao Māori in their future teaching

"That camp was... a master class in building relationships" (David)

"Their role is to learn how to develop relationships with students outside the classroom." (Meredith; Leader)

THEME 3 Appreciation of the role of relationships in teaching (Kincade et al., 2020)

THEME 2 Confidence in teaching environmental education (Thomas, 2020)

"You can do those outdoor activities... and still turn it into measurable, scientific and cultural learning." (Rose)

8 of the 9 pre-service teachers reported engaging with environmental education with their classes

4. Conclusion and Implications

- *Kiwi Forever* successfully impacts the future teaching of pre-service teachers in Aotearoa, in line with its goals.
- Place-based programs which actively involve iwi should continue to be offered to pre-service teachers in Aotearoa New Zealand.
- Future research is recommended to understand the impact of *Kiwi Forever* on the secondary students who attend the program.

References

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Leigh-ana designed this maihi motif to acknowledge the new growth of Kiwi and Whio as a result of the *Kiwi Forever* program. The twin koru shows the pre-service teachers collective role as nurturers and protectors of new knowledge.

Art by Canva

IDENTIFYING TEACHERS' LEARNING ECOLOGIES FOR TEACHING SCIENCE

Mandy Gundersen (researcher), Maurice Cheng (supervisor), Kirsty Perry (artwork).

1. CURRENT PROBLEM

People lack understanding of what teachers know and bring to the classroom. As such, teachers are frequently blamed for poor educational outcomes (1), leaving them feeling undervalued (2). A greater awareness regarding a teachers' knowledge base, and how they use this when making curriculum decisions, is needed.

2. BACKGROUND

Funds of Knowledge (FoK) are historically accumulated and culturally developed bodies of knowledge and skills essential for household or individual functioning and wellbeing" (3). Learning ecologies expands on FoK by focussing on more contexts of learning (represented by **tree branches**) and how they compliment our overall learning.
In this project, we identified science teachers' learning ecologies that contribute to their teaching practice.

3. AIM

To show that teachers possess extensive learning ecologies beyond their formal teacher training and that they draw on their learning ecology to design engaging and relevant science lessons for students.

5. DATA

Hobbies (Sport and Fitness) - A "Who Is The Most Powerful" challenge to contextualise physics in a fun, active way.

Colleagues – submerging a student in a wheelie bin full of water to calculate the "Density of a Student" in a memorable way.

Past Work (Pharmacist) - Linking solubility concepts to the clearing of IV lines using a problem-solving mindset.

Past work (Industrial Chemist) + School – Evolution of the "Vaping" lesson with demonstrations, combining state change, electricity, lung function and socio-scientific issues.

Distributed resources + whenua + school – Human impact on bird migration in a local context (prompted by an internet article on birds colliding with a building).

Whānau + Whenua – collaboration with haukainga (local whānau) to share knowledge of te Taiao, such as land features, bush and animals, to develop student understanding of sustainability.

4. METHODOLOGY

Six science teachers were interviewed twice. In the first interview teachers were asked about:

1. Their background and life experiences,
2. How they used knowledge and skills acquired in various contexts to inform their teaching practice (**fruit which falls into the kete**),
3. Lessons/activities they were most satisfied with.

From this data, we produced a diagram representing the teachers' learning ecologies.

In the second interview we invited teachers to elaborate on particular learning contexts and how they build a learning ecology for their teaching.

6. FINDINGS ACROSS PARTCIPANTS

- Through life experiences, teachers acquire Funds of Knowledge that are distinct from but complementary to that which is learnt in formal teacher training.

- Together, learning from various contexts combines to create learning ecologies which are rich, unique and valuable in different ways (**different teachers have different fruit in their kete**).

- Teachers provided diverse examples of how they drew on their learning ecologies to design engaging and relevant learning experiences for students.

7. KEY MESSAGE

Teachers are a valuable source of rich knowledge, acquired through diverse experiences, which they draw on to provide quality learning opportunities. By identifying what teachers know and do in the classroom, this asset-focused research values and highlights teachers' varied learning ecologies, helping challenge negative conceptions of teachers which may exist.

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Exploring INDIGENOUS Picturebook Publishing Practices

an investigation by Maria Scaletti

What was the problem:

Limited research exists on Indigenous picturebook publishing practices and processes, hindering an understanding of the landscape and impact of Indigenous publishers globally.

What did we do:

- Conducted a literature review
- Identified and investigated Indigenous publishers
- Analysed publisher websites
- Examined recently published picturebooks
- Created four case studies on Indigenous picturebook publication houses

supervised by
A/Prof. Nicola Daly,
Dr. Julie Barbour and
Dr. Nic Vanderschantz

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Magabala Books
www.magabala.com

cooee mittigar
A STORY ON DARUG SONGLINES

- Indigenous-led publishing house in Australia.
- Established in 1984 to empower Indigenous voices.
- Exclusively features Aboriginal and Torres Strait Islander creators.
- Provides grants and scholarships for Indigenous storytellers and artists.
- Sustained by governmental and private partnerships.

Black Bears & Blueberries Publishing
www.blackbearsandblueberries.com

FOUR HILLS OF LIFE FOR CHILDREN

- Indigenous Publishing house in the USA
- Motivated by collaborating with Native authors for cultural literacy.
- Actively seeks and publishes works by Indigenous authors and illustrators.
- Aims to fill representation gaps by capturing Indigenous cultures and perspectives in published books.

Four Case Studies

Inhabit Media
www.inhabitmedia.com

Inconvenient SKIN
SHANE.L.KOYCZAN

- First Inuit-owned publishing house in Canada, est. 2006.
- Aims to address Nunavut culture representation in school materials and preserve Inuit oral history.
- Supported by Government of Canada and Canada Council for the Arts.

Theytus Books
www.theytus.com

Meennunyakaa Blueberry Patch

- Prominent North American publisher in British Columbia, specialising in Indigenous voices.
- Motivated by preserving Indigenous cultures and perspectives.
- Actively seeks and publishes works by Indigenous authors.
- Has support from the Government of Canada and British Columbia for funding.

Commonalities among Indigenous publishing houses identified:

commitment to storytelling, collaboration, and education » aim to amplify Indigenous voices » prioritise Indigeneity by featuring works from Indigenous creators » rely on external funding for support » often authors and illustrators have a background in education » showcase Indigenous art

ADVANCING COMPUTATIONAL THINKING IN DIGITAL TECHNOLOGY

BYTE BY BYTE

INTRODUCTION

This summer's scholar research project is an ongoing project exploring the integration of computational thinking into digital technology practices for students who are years 4 to 6. Building on last year's study, this project delved deeper into students' understanding of algorithms, decomposition, debugging and abstraction concepts. Based on evidence from previous studies, cultural contexts have been identified as a vital component to students' learning and have been refocused in this study. Many of the students have a Māori background and as a result, the learning style reflects tikanga and mātauranga Māori.

RESEARCH METHOD

During this study, we were fortunate enough to partner with a tech company called Byte Ed. Byte Ed is a specialist education team that develops learning programmes that scaffold young learners based on a design thinking approach. They provided a unit plan and "Dino Steps" kits to help supplement student learning. Teachers involved with the project took these tools and integrated them into their lessons for students. Students engaged in individual tasks, group activities, and whole-class learning discussions throughout the five-week program. Formative and summative assessment was completed throughout. Students used various digital and unplugged manipulatives to complete tasks to gain a comprehensive understanding of computational thinking core concepts. Students' cultural needs underpinned many of the tasks to cater to the diverse learning needs presented by them.

KEY FINDINGS

MANIPULATIVES
Manipulatives proved integral in cementing student understanding of concepts

ENGAGEMENT
Student engagement was at its highest when the context centred on their cultural needs.

ALGORITHMS
During a summative assessment test, 91% of students tested got all the questions relating to algorithms correct

TEACHER TRAINING
During the course of a 3 year Bachelor of Teaching (Primary) degree, 1 week is spent covering digital technology concepts

DEBUGGING
During a summative assessment test, 59% of students tested got all the questions relating to debugging correct.

DATA ANALYSIS

PROFESSIONAL DEVELOPMENT FOR TEACHERS
The digital technology space is constantly changing. Professional development helps our teachers use the best pedagogical practices while teaching.

SUMMATIVE ASSESSMENT
Students performed best with the algorithm questions. This is attributed to the fact that it was the most familiar concept to students. The clear cross-curriculum links to math made it easy for students to draw on prior knowledge. Students struggled the most with debugging. Debugging requires using multiple computational thinking concepts simultaneously in order to do it correctly. Teachers perceived that the questions may have been too hard for the student's current understanding and that they may also lack confidence in their newfound skills.

MANIPULATIVES
Manipulatives provide students who lack literacy and numeracy skills an opportunity to succeed. Students who were struggling and felt burdened with writing in the normal literacy lessons flourished when it came to writing code and providing their reasoning.

CULTURAL CONTEXT
Students were more engaged when completing tasks that involved their home, family and identity compared to tasks that lacked this context.

FUTURE APPLICATIONS

The analysis from both this year's and last year's studies has highlighted an unequivocal need to work with teachers and provide targeted professional development around computational thinking practices. The findings underscore the vital role that educators play in successfully implementing and integrating computational thinking practices into the curriculum. By addressing the identified gaps and nuances of computational thinking practices, we hope that educators will feel empowered and that effective classroom instruction can occur. We also acknowledge that teachers can be busy, and we do not wish to further inundate them with cumbersome training. We are optimistic, however, as many computational thinking concepts have cross-curriculum links to literacy, numeracy, and science. Further research will be needed to identify the most effective way to implement these practices.

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ByteEd

Dr Wendy Fox-Turnbull
Associate Dean of Academic Education PVC's Office
Associate Professor Education PVC's Office

Matthew Stafford
Bachelor of Teaching (Primary)

MIDDLE LEADERS IN NEW ZEALAND SCHOOLS:
Mastery, Muddle and Mystery?

Who are New Zealand schools' middle leaders?

In Aotearoa New Zealand, middle school leaders (ML) encompass a large and diverse group of educators who, in addition to their classroom teaching responsibilities, provide pedagogical, pastoral, and cultural leadership. They build collegial relationships, lead teams, manage resources, engage with stakeholders and fulfil various administrative functions (Ministry of Education, 2012).

Research Rationale and Design

- While senior leadership roles have been extensively studied, little is known about what middle leaders actually do and how they experience their role.
- Research elsewhere (Grootenboer et al., 2023) shows how ML impact student achievement and school culture.
- ML is both a stepping stone to senior roles and a career destination in itself (MOE, 2012).
- There is a growing need to explore the preparation, practice, and positioning of both novice and experienced ML, hence this research.
- The research design comprises a national survey to be conducted in March 2024.
- Findings will offer insights to inform policies and practices in education and organizational leadership.

MIDDLE LEADERS' PRACTICES

- Middle leaders play a crucial role in fostering a collaborative and supportive structure within the organization (Li et al., 2021).
- Their influence extends beyond managing tasks to leading people, both within and beyond their traditional spheres. This includes taking initiatives, providing direction, resolving tensions, and addressing conflicts (Day & Grice, 2019).

Please scan here for the online survey

MIDDLE LEADERS' PRACTICE TENSIONS

- With time constraints in their role, middle leaders may experience exhaustion and overwhelm, leading to role conflict.
- This struggle involves balancing the demands of classroom teaching with leadership expectations. ML often find themselves pulled in two directions—managing the needs of their team while fulfilling the expectations of their senior colleagues (Kelly, 2019).

Scholar: Thao Hoang – Supervisor: Dr. Michele Morrison
Division of Education

Please scan here for references

Social Media and Research Ethics

Summer Scholar: Zaida Moffat » **Supervisors:** Dianne Forbes, Suzette Dyer, Nic Vanderschantz

» How ethical is the use of social media?
» What common issues arise & what principles should be followed to ensure social media use in research is ethical?

This project explored the risks associated with research using social media, through searches of literature and policy, and short structured interviews. The results of this research will be used to inform ethics policy for the University of Waikato.
We thank the participants of this project for their contributions.

Defining characteristics of social media-based research: There are two main methods of data collection: as a research tool - e.g., to recruit research participants; and as a research focus – e.g., to research the activity and content on a social media platform (Government Social Research Profession, UK, 2016). Social media research provides quick access to readily searchable quantitative and qualitative data. However, it cannot be assumed that this data is unproblematically in the public domain, or that it can be ethically used for research purposes.

Standard ethical principles for human research:
- Do no harm
- Informed consent
- Privacy
- Mitigate risk

- **Including:**
  - o Respect
  - o Cultural awareness
  - o Commitment to learning and sharing knowledge
    (University of Waikato, Ethical Conduct in Human Research and Related Activities Regulations, 2008, p.1)

Reference List:

Key risks identified with social media research:
- Rapid change
- Legal and ethical compliance of providers
- Public and private settings: anonymity & confidentiality for users/participants
- Informed consent
- Participation of vulnerable persons
- Authenticity of data
- Researchers must avoid deception, & not fabricate online identities to gain access to communities online (National Ethics Advisory Committee, NZ, 2019, p.146)
- Data security and sovereignty: hacking, identity theft, data ownership, use of information (Lunnay et al., 2014, p.7).

Key outcomes for the University of Waikato to consider?
- Research with social media involves human participants and is subject to ethical approval AND ethical principles (informed consent, mitigation of harm) apply
- Research is subject to the Terms and Conditions/Terms of Use of the specific social media platform AND awareness of terms/conditions changes required
- Anonymity is compromised by the discoverability and searchability of social media data
- Implications for data sovereignty – e.g., of Tangata Whenua, require consideration
- Verification of data is required to address user deception and biases within data collection

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

FOSTERING RACIAL ALLYSHIP
AMONG PSYCHOLOGISTS IN AOTEAROA NEW ZEALAND
BY SVANTE JOHANSSON, SUPERVISED BY ASSOC. PROF. WAIKAREMOANA WAITOKI & DR KYLE TAN

INTRODUCTION

Racism significantly impacts mental health in Aotearoa, especially among Māori, Pasifika, and Asian groups.[1]

Racist rhetoric hinders Māori's rights under Te Tiriti to tino rangatiratanga (self-determination) in health care.[2]

With these challenges, anti-racist allies in psychology is essential to public health.

Racial allies are people who recognise their undeserved advantages from social inequities and actively fight unjust laws and practices.[3]

Our aim was to measure the attitudinal factors correlated to racial allyship to better inform future interventions in psychology.

METHOD

Psychology practitioners and trainees participated in our online survey which used a five-point Likert scale with questions contained in three sections:

1) Attitudes towards Māori perspectives and world views (taha Māori).

2) Attitudes to racism, in terms of acknowledging colonisation and settler privilege as a current problem.

3) Attitudes surrounding allyship: How active participants are in self-education and opposing injustices they are not directly affected by.

RESULTS

Both 'attitudes towards taha Māori' and 'attitudes to racism and colonisation' were correlated with anti-racist allyship, although the latter had a higher predictive power.

The correlation between the attitudinal factors and anti-racist allyship remain even after adjusting for demographic factors (e.g., age, ethnicity, and entry period into psychology training) and social desirability bias.

DISCUSSION

Participants supportive of incorporating taha Māori in psychology generally recognise historical racial injustices affecting Māori and minority mental health in Aotearoa.

Upskilling psychologists in taha Māori and racism is crucial to address the current gaps in training in Indigenous and culturally diverse psychology, respond to the Waitangi Tribunal claim, and create platforms for Māori to exercise tino rangatiratanga in Indigenising psychology.[4]

Bridging these gaps will benefit all groups as envisioned in Te Tiriti o Waitangi, fostering equal opportunities for all in the discipline.

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Irawhiti Takatāpui
Wellbeing of Trans & Non-binary Māori

Shawnee Cunningham, Supervised by Kyle Tan, Logan Hamley & Jaimie Veale

Te Pua Wānanga ki te Ao: Faculty of Māori & Indigenous Studies

INTRODUCTION

The Counting Ourselves survey investigates health inequities and social determinants of health for transgender and non-binary people in Aotearoa. Building on the first study, our project aims to develop a comprehensive resource highlighting key issues for irawhiti takatāpui (gender-diverse Māori), while emphasising the strengths associated with this identity. Guided by **Te Whare Takatāpui**, a te ao Māori-based framework that aims to enhance takatāpui health and well-being, this project will be a significant step toward addressing disparities impacting our takatāpui communities.

METHOD

We analysed data collected through the 2022 Counting Ourselves survey using responses from Māori participants (N = 366). The survey included 200 questions on various topics, including mental health, discrimination, intersectionality, community connection & social support.

We are currently drafting a report of the findings, guided by the Te Whare Takatāpui Framework, which incorporates six core values, each representing distinct aspects of the wharenui (ancestral meeting house). For takatāpui to flourish, all six values need to be nurtured and sustained.
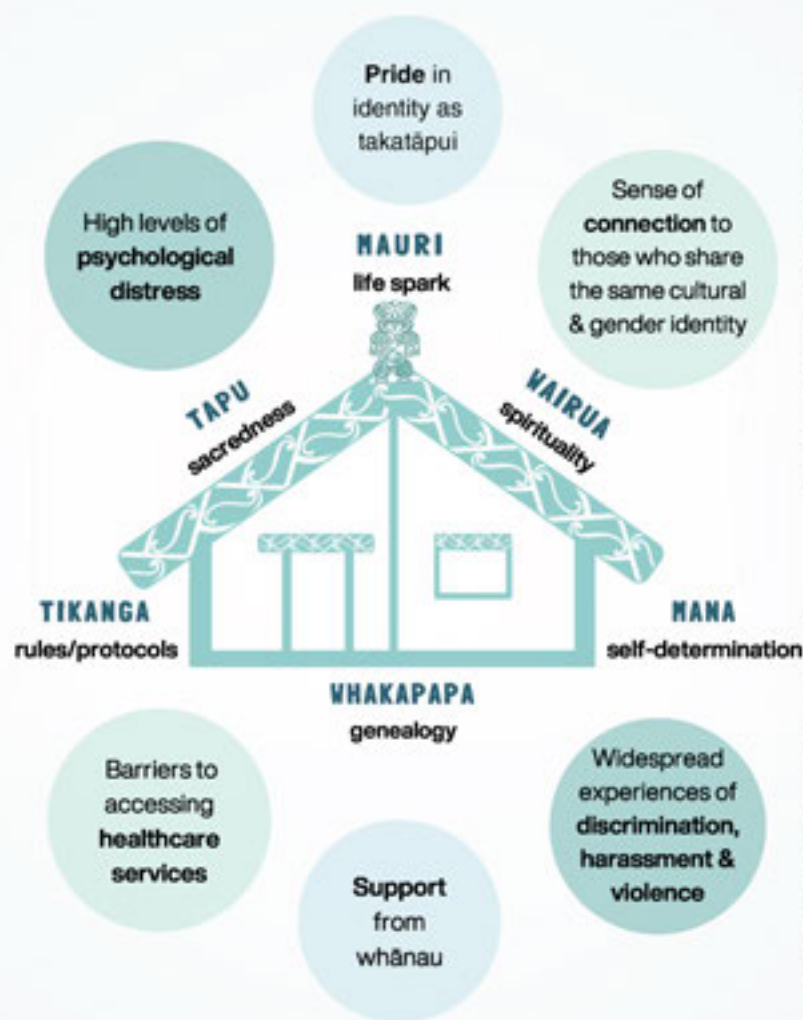
DISCUSSION

From these findings, we see that identity pride, community connection and whānau support emerge as key strengths for irawhiti takatāpui, corresponding to values of wairua, mauri, mana and whakapapa. These findings also highlight key issues, such as heightened psychological distress, discrimination, and barriers to healthcare access, which adversely effect all framework values and contribute to disproportionate disparities experienced by takatāpui.

CONCLUSION

These initial findings provide a brief overview of what health and wellbeing currently looks like for irawhiti takatāpui, while highlighting the potential of the Te Whare Takatāpui framework. The next stage of this project involves formulating recommendations for the final report that will promote and protect the wellbeing of irawhiti takatāpui, serving as a call to action to address these key issues.

Pride in identity as takatāpui

Sense of **connection** to those who share the same cultural & gender identity

High levels of **psychological distress**

MAURI life spark

TAPU sacredness

WAIRUA spirituality

TIKANGA rules/protocols

MANA self-determination

WHAKAPAPA genealogy

Barriers to accessing **healthcare services**

Widespread experiences of **discrimination, harassment & violence**

Support from whānau

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COUNTING OURSELVES

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RUTHERFORD FOUNDATION

ROYAL SOCIETY TE APĀRANGI

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

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Te Huataki Waiora – School of Health

Lupus in the Waikato: Demographics, Diagnosis, Drugs & Database

Poster by Daniel Darlington
Supervisors – Philippa van Dantzig, Douglas White, Chunhuan Lao, Ross Lawrenson

Background

Systemic Lupus Erythematosus (SLE) is a rare, multi-system autoimmune disease that ranges in severity. In recent years, the 2019 European League Against Rheumatism/American College of Rheumatology (EULAR/ACR) classification criteria were released to assist in the classification of SLE patients. It is made up of a set of clinical and immunological criteria which requires a patient to have a total score of 10 or higher with at least one clinical feature and an ANA titre >1:80 to support a diagnosis of definite SLE.[1]

Recent epidemiology research within New Zealand has shown the incidence of SLE to be 2.1 per 100,000 people and prevalence to be 42.1 per 100,000.[2]

Hydroxychloroquine (HCQ) is the 1st line treatment for controlling SLE, though some patients experience side effects (rash, nausea, etc,) and long-term exposure carries the rare risk of retinal toxicity which can lead to irreversible visual loss. This study also sought to look at how common discontinuation of HCQ was due to intolerance and retinal toxicity in this patient cohort.

This is the first study to analyse the clinical, immunological and management features of SLE patients in Waikato, also providing a database for further research into the disease.

Aims

- To describe the clinical and immunological features of patients with SLE in the Waikato
- To assess retention on hydroxychloroquine
- To build a database of lupus patients for future research

Methods

Lists of patients attending the Waikato Rheumatology clinic between October 2021-February 2022 were used. Patients were added prospectively when attending clinic during the data collection phase of the study (November 2023 to December 2023). Patients' electronic medical records were screened and those with a diagnosis of SLE or possible SLE were included for further analysis. Data was collected retrospectively on demographics, clinical and immunological features, management and mortality by DD and reviewed by supervisors PVD and DW to adjudicate as definite SLE (meeting EULAR/ACR criteria and clinically fits with diagnosis), probable SLE (2-3 criteria) and possible SLE (1 criterion). This identified 105 patients. Disease characteristics were compared by gender and ethnicity and the difference was examined by chi-square test for categorical variables and independent sample t-test or one-way ANONA for continuous variables in IBM SPSS 29 (New York, United States).

Results

Ethnicity (n,%)
- European 72, 68.6%
- Māori 11, 10.5%
- Asian 18, 17.1%
- Pacific 4, 3.8%

Sex (n,%)
- Female 93, 88.6%
- Male 12, 11.4%

Diagnostic Certainty (n,%)
- Definite 75, 71.4%
- Probable 23, 21.9%
- Possible 7, 6.7%
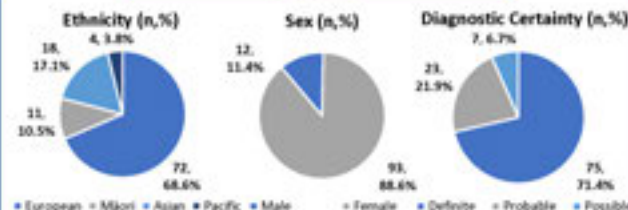
Subgroup	Total (n = 104)		Average Age at Diagnosis (SD)	Range	p-value*
Sex	n	%	years	years	
Female	92	88.5	34.6 (16.8)	10 - 74	0.002
Male	12	11.5	51.1 (16.1)	24 - 73	
Ethnicity					
European	72	69.2	39.4 (17.8)	10 - 74	0.079
Māori	10	9.6	33.4 (13.9)	13 - 53	
Asian	18	17.3	28.9 (15.6)	11 - 60	
Pacific	4	3.8	27.5 (17.7)	15 - 53	

Clinical Manifestations by Ethnicity (%)
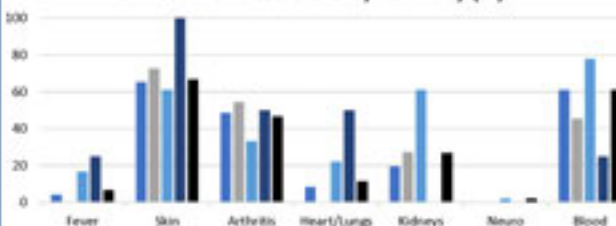
Immunological Manifestations by Ethnicity (%)

Legend: European, Māori, Asian, Pacific, Total
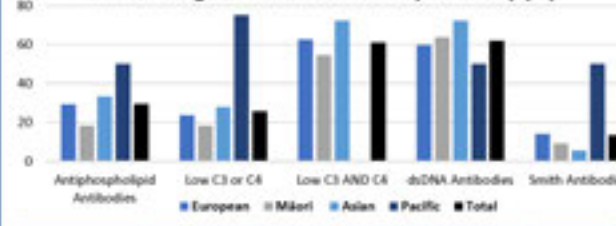
Key Clinical Manifestation	European (n = 72)	Māori (n = 11)	Asian (n = 18)	Pacific (n = 4)	p-value*
Skin	47	8	11	0	0.816
Arthritis	35	6	6	2	0.640
Lungs/Heart	6	0	4	2	0.021
Kidneys	14	3	11	0	0.002
Blood	44	5	14	1	0.143

*p-value less than 0.05 was deemed statistically significant

HCQ Discontinuation due to Side Effects

Ever on HCQ (n=91): 73, 12, 6

Legend: No side effects, Discontinued due to other side effects, Discontinued due to retinal toxicity

Discussion/Conclusions

This data paints an important clinical picture of our SLE patients in Waikato. Most patients are of European descent (68.6%). There is also a greater population of females compared to males, with a sex ratio of 7.75:1 in our sample which is consistent with prior national and worldwide results.[2,3]

Males are diagnosed at an older age compared to women, (51 vs 35, p=0.002) but there were no statistically significant differences between ethnic groups. Additionally, while most patients can be regarded as definitely having SLE according to EULAR/ACR criteria (71.4%), there is still diagnostic uncertainty in 28.6%, highlighting the difficulty to diagnose SLE. Kidney disease attributable to SLE was more frequent in the Asian group compared to other ethnicities, (61.1% vs 26.7% total cohort).

Immunologic manifestations were common, with low complement (either C3, C4 or both) occurring in 86.7% and dsDNA or Smith antibodies being present in 65.7% of patients in our cohort, though there was no significant difference noticeable between groups.

Ninety-one patients (86.7%) were known to have been treated with HCQ at some point during their disease. Eighteen (19.8%) had experienced side effects severe enough to stop treatment with 6 of these being due to concerns of retinal toxicity (6.6%). Retention on hydroxychloroquine is higher than expected.

It is accepted that this cohort will not include all patients with SLE in the Waikato. Only those attending rheumatology clinics will be captured with the current methodology. More SLE patients will be added to the database over time. This database can then be used for future cross-sectional studies, to recruit patients for clinical drug trials targeting the disease, and to identify patients who may benefit from new treatments, as they become available.

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Arthritis NZ Mateponapona Aotearoa

Re:Play
REIMAGINING CHILD-LED COACHING

Play

Recent research has highlighted the benefits of play in young people's development (1). The ability of children to engage in play is considered a fundamental human right (2). Yet recent reports from Sport NZ are recording a decrease in engagement in play for young people (3). The focus of this research is to understand how children perceive the concept of play.

RE:PLAY Club

The RE:Play Club is a collaborative project between the University of Waikato, Sport Waikato, and the University of Newcastle. The aim of RE:Play is to develop an approach to sports coaching based on choice and co-development with young people. This research is the pilot study for this project.

Methodology

45 children aged 7-12 came to the University of Waikato campus for 8 multi-sport sessions. 12 coaches were trained and encouraged to deliver child-centred, play-orientated sessions. Throughout the club, the children were prompted to produce drawings and subsequently interviewed to understand their perceptions of play. Thematic analysis took place, highlighting key themes and insights from the children.

Results

Each child has unique needs in order to play. The key themes from the drawings and interviews were:

- Being with friends
- Quality relationships with coaches
- Preferred unstructured coaching
- The freedom to choose activities

(Participant Drawing)

Next Steps

Two key challenges have been identified moving forward:

1) For coaches to build learning environments that prioritise play by using the conditions identified in the drawings and interviews

2) For coaches to deliver sessions in an unstructured environment, allowing children to sample activities and explore fun

Researcher: Fin Sherlock
Supervisors: William Roberts, Robert Townsend, Amy Marfell
School of Health, University of Waikato

With thanks to Sport Waikato and The University of Newcastle

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Factors Contributing to Sub-optimal Medication Prescribing

Posted by Jinru Zhao Supervised by Lynne Chepulis

THE UNIVERSITY OF WAIKATO
Te Whare Wānanga o Waikato

Introduction

Type 2 diabetes (T2D) is a prevalent health concern affecting approximately 300,000 individuals in New Zealand, with a notable impact on Māori and Pacific populations.

In this poster we are looking at the medication possession ratio (MPR) for patients taking Jardiance (Empagliflozin) or Jardiamet (Empagliflozin with metformin hydrochloride). leveraging comprehensive datasets comprising approximately 55,000 patients with T2D, obtained from the National Pharmaceutical dataset.

Methodology

Data were retrieved from four primary care datasets, taking all dispensing records of diabetes patients from Feb 2021 to July 2022. MPR was calculated for each patient, dividing the total days covered by dispensing events by total days of observation (days counted from each patient's first dispensing event to the end date of the study period). Missing values in the days' supply column were filled with inferred values in the data cleaning steps. Patients with less than 2 dispensing events were excluded from the research.

Findings

Maori and Pacific females tend to have lower MPR compared to the other ethnic groups

Fewer Asian and European patients have low MPR (MPR <= 0.5) than Maori and Pacific patients

Having an MPR larger than one means the patient get their medication dispensed again before exceeding the refill interval

TAHA TINANA

Graphs

Mean MPR by Ethnicity and Gender

MPR by Ethnicity and Gender
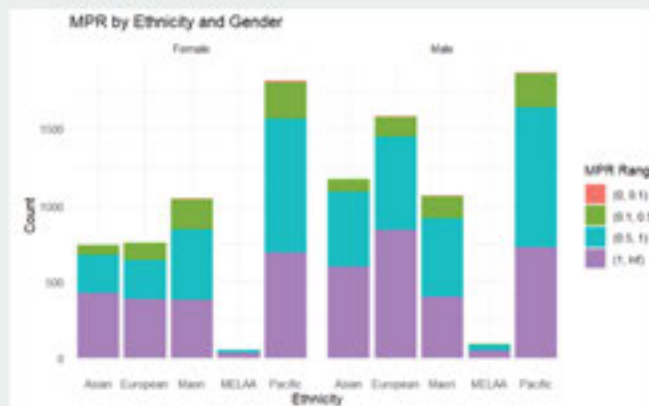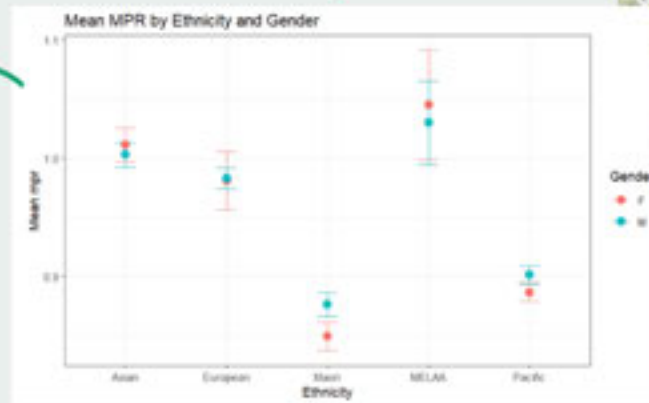
Discussion

Ideally, MPR are expected to be around 0.8, showing the majority of patients were taking their medication correctly 80% of the time. However, almost half of the patients had MPR exceeded 1. This might prompt a further investigation into issues related to overdose or the sharing of pills. By avoiding these situations, the government could save its budget on medication funding.

Health-system Factors Contributing to Inequity in Diabetes Medication Use: Exploring Patient Views of the Piki te Ora Extended Primary Healthcare Team at Te Korowai o Hauraki

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Karis Gordon, Sara Mustafa, Rebekah Crosswell, Lynne Chepulis

Medical Research Centre, Te Huataki Waiora School of Health, University of Waikato

TE KOROWAI
HAUORA O HAURAKI

INTRODUCTION

BACKGROUND

Type 2 Diabetes is a chronic health condition which affects over 220,000 people in New Zealand[1], with Māori and Pacific populations disproportionately affected. This inequity remains today. Further to this, in primary care Māori and Pacific populations are more likely to experience inequity in diabetes medication and management[2]. Prior studies on primary care interventions have found that interventions more suited to the patients improve health outcomes[3] and reduce related health complications. As a result, this study aimed to explore the impacts of Piki te Ora, an extended primary care team, on diabetes management for patients in the Hauraki/Coromandel area.

RESEARCH OBJECTIVES

The objective of the research was to **evaluate the Piki te Ora service.**

The sub-aims included
- What is working
- What is not working
- What could be improved

RESEARCH

METHODS

10 qualitative interviews were carried out face to face (6), via zoom (2), and via phone call (2). Inclusion criteria required participants being enrolled in the Piki te Ora programme at Te Korowai o Hauraki. Participants were recruited via a mass text message inviting participants to discuss their experience with Piki te Ora as a semi-structured interview. The interviews were audio-recorded and transcribed. Thematic analysis was used to analyse the transcripts for codes and themes related to research objectives. Transcripts were analysed by a group of researchers.

PARTICIPANT QUOTES

"I'm quite disillusioned now with Western medicine"

"I've always avoided the health service. And I'm a lot more comfortable actually talking to medical professionals [after the programme]."

"And we had a long chat, and a long... And she was at great pains to make me comfortable"

"But Te korowai has kind of gone. Okay. That's where you were, how can we work with you"

RESULTS

The initial thematic analysis produced codes in the data which have suggested common themes of Manaakitanga/Care, Education, and Flexibility in Health Care Delivery in Piki te Ora which supported diabetes management. However, further analysis of the codes is being undertaken to produce the more concrete themes.

This initial analysis also produced codes regarding improvements for the service, including more communication about being enrolled in the programme, a more specialised approach for some participants, and whanau education being offered. Again, further analysis is required to frame these codes.

"I've got a lot of help from Te Korowai. Yeah. From the staff there, and with them sort of what I call batting for me, yeah. And making sure I'm doing as I'm supposed to be doing. Yeah. Things are a lot easier."

"I suppose they care more."

"I think youse are doing a great job. Really. I'm satisfied with how it's turning out"

CONCLUSION

CONCLUSION

Type 2 Diabetes is a complicated condition to manage, and patients rely on primary health care to provide the tools for management. A responsive programme such as Piki te Ora provides patients with education around diabetes and aims to work in with their lives. This research has the potential to help inform other healthcare practices to provide this model of care moving forward for diabetes management to improve health outcomes

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ACKNOWLEDGEMENTS

The Māori Women's Welfare League – Need, Awareness, Succession HREC(HECS)2021#55

Kāteao Barber-Horne, supervised by Dr. Gloria Clarke

Background

Established in the 1950s, Te Rōpū Wāhine Māori Toko i te Ora (Māori Women's Welfare League – MWWL) has been a cornerstone in supporting the wellbeing of Māori women and their families (Szaszy, 1993).

Currently, there are over 130 peka (branches) in Aotearoa and Australia.

The relevance of the MWWL in the lives of female Māori students at The University of Waikato is unclear.

Our exploration ascertained student awareness of the MWWL and their activities, and surveyed their distinct welfare needs and interest in joining an age-diverse or rangatahi (youth) MWWL branch.

Research questions

What is the level of awareness among female Māori students (past and present) studying at The University of Waikato regarding the MWWL?

What are their welfare needs, and to what extent are they interested in being involved with the MWWL?

Methods

Spoke with local MWWL peka members
To understand their mission and vision for the future of the League.

SurveyMonkey
Bilingual anonymous online survey consisting of 20 open and closed questions.

Data Analysis
Identified patterns in the data including welfare needs, levels of awareness, and interest.

Top 12 Welfare Needs

54 RESPONDENTS

- Being Politically Aware & Active
- Connection to the Taiao
- Mentorship (e.g., Business, Leadership)
- Connection with other Wāhine
- Education & Career Development
- Māori Language & Māori Custom
- Gardening & Food Production
- Public Speaking
- Traditional Plant Remedies
- Financial Literacy
- Business Flourishment
- Serving the Community

79% — Awareness of MWWL
36% — Knowledge of MWWL activities
96% — Interest in joining
96% — Willingness to receive support
All Ages Branch — Rangatahi Branch

Conclusion

These 54 ākonga (students) are aware of the MWWL but have limited knowledge of their activities. They identified a range of welfare needs and indicated a willingness to receive support from the MWWL. Respondents indicated a clear interest in joining the MWWL and a preference to join an age-diverse branch rather than a rangatahi branch. This is likely to be related to the nature of their welfare needs i.e. to benefit from the life experiences of older wāhine (women). Their list of welfare needs presents an opportunity for MWWL branches within the vicinity of the university to provide tailored initiatives for ākonga.

Reference: Szaszy, M., Rogers, A., Simpson, M., & Kāwharu, M. (1993). Early stories from founding members of the Māori Women's Welfare League: Te Timatanga tātau tātau, Te Rōpū Wāhine Māori Toko i te Ora. Bridget Williams Books Ltd.

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Whiria Te Tāngata: A qualitative analysis

Introduction

As a result of ongoing colonisation, Māori are three times as likely to have Type 2 Diabetes (T2D) when compared to non-Māori. (1) Many individuals with T2D receive sub-optimal management in primary care, leading to worse health experiences and outcomes. (2,3) One initiative aiming to change this is Whiria Te Tāngata, nurse practitioner-led, Marae-based clinics run across Taupō and Tūrangi. This research aims to explore Māori T2D patients experience at these Marae-based clinics.

Method

Qualitative kaupapa Māori-informed semi-structured interviews were completed in Dec 2023, involving 11 participants (9 male, 2 female), all of whom were Māori. Recruitment was initiated by the lead nurse practitioner of Whiria Te Tāngata, who approached patients with T2D, and was then completed by a summer research assistant, who contacted those interested. All interviews were audio recorded, transcribed orthographically, and thematically analysed.

Results

Mainstream

"Like I'm just a number."

"I felt I was hard done by."

"And it's costly so you don't... try not to see them that much anyway."

Marae-based

"I get better service with the Māori care."

"...it's free."

"We work together to get me better..."

"Take more care and time with you."

Aspirations

"But it'd be good if... we had more of our people in the... medical... profession."

"...[diabetes] needs to be taught in schools to our children."

"...out in the māra... growing kai."

Conclusions

This research shows that while New Zealand's mainstream health system and its model of healthcare delivery is failing Māori with T2D, initiatives such as Marae-based health clinics are playing a key role in remedying this. One major theme identified was health system barriers including cost, poor therapeutic relationships, and lack of continuity of care. Another major theme was the effectiveness of by Māori, for Māori approaches to healthcare where participants emphasised the manaakitanga (care), whanaungatanga (building of relationships), and akiaki (encouragement) they experienced while at the Marae-based clinics. Finally, the need for anti-racist action to be taken at all levels was a major theme encompassing more education on health in kura, kai sovereignty, and investment in more Māori health professionals.

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By Keimarire Tibble-Brown, Rebekah Crosswell, Hine Loughlin and Lynne Chepulis

Te Huataki Waiora School of Health, University of Waikato, New Zealand

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Te Whare Wānanga o Waikato

Ribosome and Phage Display for Nanobodies against TNF-alpha

Kevin Beijerling, Iman Kavianinia
and William Kelton

Introduction

Tumour necrosis factor alpha (TNF-alpha) is a highly inflammatory cytokine implicated in conditions like IBS, insulin resistance, and some cancers.

Using antibody panning techniques like Ribosomal and Phage Display, we are screening for single-domain antibodies or 'nanobodies' that bind to TNF-alpha as a potential inhibitor.

Methods

Nanobody mRNA library is panned by ribosomal display for TNF-alpha binders (Figure 1a and 1b).

Recovered sequences are cloned into plasmids and transformed into E. coli for amplification (Figure 1c).

Phage-linked nanobodies undergo two rounds of phage display to screen for highly selective binders. Binding sequences are sub-cloned and expressed for analysis (Figure 2).

Figure 1. Panning for TNF-alpha Nanobodies via Phage Display

Figure 2. Refining TNF-alpha Nanobodies via Phage Display
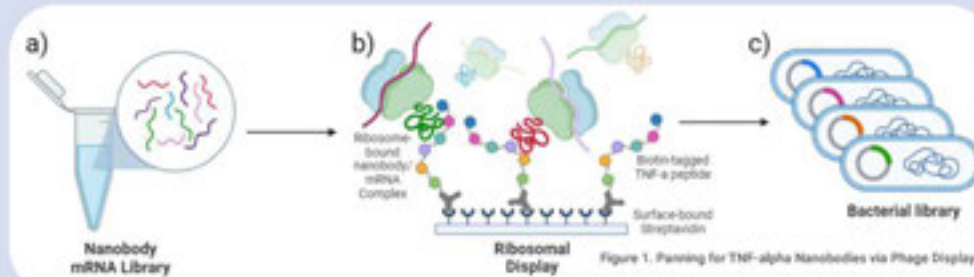
Results

Preliminary data (Figure 3) shows that enough library diversity made it through from the ribosomal display screening for a successful initial phage panning.

Approximately 11.5 x 10^12 and 25 x 10^12 phage/mL were produced and purified from the phages recovered.

We are currently preparing for the second round of phage panning, followed by analysis of the nanobody sequences.
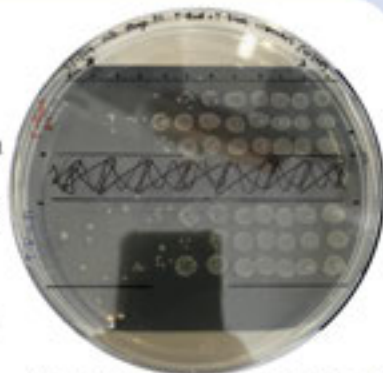
Figure 3. Phage Infection Titre from R1 Phage Display.

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AUCKLAND
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NEW ZEALAND

Investigating Desirable Attributes of Medical Graduates

Mekayla Peneha, Supervised by Dr. Gloria H. Clarke

BACKGROUND

Health disparities for Māori and Pacific peoples are prevalent, and even more so in remote and rural communities where access to healthcare services is limited (Crengle et al., 2022).

In response to this, two pilot studies aimed at exploring the healthcare experiences, needs and aspirations of Māori and Pacific peoples residing in Te Rohe Pōtae (King Country, Waikato) were conducted, supporting the proposal for a third medical school at the University of Waikato (Galewski & Katipa-Maikuku, 2022).

AIM

This summer research project (Project 51) expands on the pilot studies and explores the healthcare experiences, needs, and aspirations of Māori and Pacific peoples living in Ngāruawāhia. The intention is that our findings will inform the University of Waikato Graduate Medical School curriculum.

RESEARCH QUESTIONS

- What does rural and remote mean to Māori and Pacific peoples living in Ngāruawāhia?

- What are the healthcare experiences of Māori and Pacific peoples living in Ngāruawāhia?

- What are the healthcare needs and aspirations of Māori and Pacific peoples living in Ngāruawāhia?

METHODOLOGY

Literature
The literature review focused on the two pilot studies conducted in Te Rohe Pōtae.

Survey Design
Shaped using questions from the pilot studies and demographic knowledge of Ngāruawāhia. Google Forms was the survey platform, it was anonymised and consisted of 20 questions. A poster with a QR code and survey link was created for easy accessibility.

Community Discussions
Contacted local community groups, discussed and requested permission to display posters with survey information at their establishments.

Poster Distribution
Distributed posters with survey links to the local kura, medical centre and church. Also circulated information on social media platforms.

SURVEY CRITERIA

- Māori and/or Pacific descent
- 18 years or older
- Living in or near Ngāruawāhia

REFERENCES

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FINDINGS

We received 22 responses. **16** responses met our survey criteria and this consisted of 14 females and two males, with one male identifying as Pacific.

RESPONDENTS

Respondents characterized rural areas as encompassing farmland and countryside and being a distance from a city or highly populated town. On the other hand, respondents defined remote areas as having limited or no access to services and residing far from a town. 50% of respondents considered Ngāruawāhia to be rural.

Where do respondents go when ill or injured?
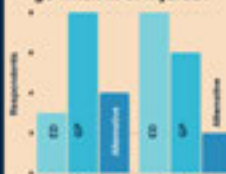
Most respondents (80% of respondents) expressed dissatisfaction with the care received at the ED or GP. Negative feedback included long wait times, discrimination, feelings of racism and a lack of interpersonal skills. It is also important to note that for those who sought alternative approaches, their action could be seen as a response to the negative feedback mentioned and these respondents, were satisfied with the care they received through these alternative approaches.

*Alternative options include the Pharmacy, Rongoā Māori, self-help through online searches, or contacting Healthline.

In your opinion, are the healthcare needs of Māori and Pacific peoples living in Ngāruawāhia different or the same as other community members?

- 12.5%
- 31.3%
- 56.3%

- Different
- Unsure
- The same

Māori and Pacific peoples of Ngāruawāhia want their healthcare providers to have:

Empathy	Cultural Understanding	Community knowledge
"Really listen to me, have empathy"	"Understanding of Māori and Pasifika kaupapa frameworks and the Kīngitanga"	"Build a good relationship with the people in the community"

56.3% of respondents believe that the health needs of Māori and Pacific peoples in Ngāruawāhia are different in comparison to other community members. Respondents highlighted the three skills and characteristics above, as those that they hope to see in new healthcare providers in Ngāruawāhia. Seven respondents mentioned cultural understanding. This highlights that these respondents see it as important in fostering competent care. Five respondents mentioned empathy and the importance of listening. Four respondents mentioned the importance of health providers having sound knowledge of the community, for more effective service delivery. Te listed services on the side are what the Māori and Pacific peoples of Ngāruawāhia hope to see in their community, as they feel these will help with better health outcomes.

What kind of services do you want or need?

- Full Maternity
- More Māori Healthcare Facilities
- Another GP service
- Child Psychology Services
- Mental Health Services

CONCLUSION AND RECOMMENDATIONS

- 50% of Māori and Pacific community members of Ngāruawāhia view their location as rural based on their understanding of the term.
- The healthcare experiences of Māori and Pacific peoples in Ngāruawāhia are primarily negative.
- Māori and Pacific community members expressed that cultural understanding, empathy and community knowledge are essential skills and characteristics healthcare providers should possess.
- In terms of the medical school, a class focussed on the skills and characteristics will be beneficial.
- Future research should aim to collect data from larger cohorts in different rural areas and potentially, from rural areas that are 30km or more from the nearest city.

Use of Community Treatment Orders

Nicole Bell, Anthony O'Brien, David Snell, Donna Foxall, John Hiakita, Sione Vaka.

School of Health

Background

- Community treatment orders (CTO) have been used in New Zealand since 1992.
- Section 29 of the NZ Mental Health Act (1992) requires a person to undergo compulsory psychiatric treatment within a community setting.
- CTOs are coercive, with the threat of non-compliance resulting in involuntary hospitalization.
- There is a form of compulsory community treatment in over 70 jurisdictions internationally (Mikellides et al., 2019).
- Previous research has shown an increase in CTO rates within New Zealand (O'Brien, 2014).

Research Questions

- Have CTO rates in New Zealand increased over the past 17 years?
- What Districts have the highest rate of CTO use within New Zealand?
- What is the prevalence of CTO use internationally and how does this compare to New Zealand rates?
- Are indigenous populations disproportionally over-represented in CTO use?

Method

- Extract CTO data from the publically available annual reports from the Office of the Director of Mental Health and Addiction Services New Zealand (2005-2022).
- Perform a systematic quantitative literature review for international CTO rates.
- Web search for publically available international data of CTO use.
- Contact government organisations asking for data on CTO use.

Findings

- Northland DHB had the highest rate of CTO use since 2013.
- Bay of Plenty DHB had the lowest rate of CTO use since 2013.
- The NZ national rate has increased by 36 CTOs per 100,000 since 2005.
- In 2022 the national average of CTO use was 96 per 100,000.
- In 2022 Scotland CTO rate was 23.6 per 100,000.
- Within New Zealand and South Australia indigenous populations are over-represented in CTO use (MOH, 2022; Kisely et al., 2020)

Challenges

- Not all jurisdictions recorded CTO prevalence.
- Many reports had totals, not rates.
- Qualitative literature was readily available however quantitative was scarce.

Next steps

- Continue corresponding with international government agencies to gather CTO use.
- Explore CTO use within countries that have an indigenous population.
- Generate rates of CTO use per 100,000 for all districts and countries to compare NZ rates accurately.

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Identifying barriers for Māori parents entering study in health professions

By Tiana Reihana- Te Huataki Waiora School of Health

Background

Māori health professionals are extremely underrepresented in Aotearoa/New Zealand (Wiapo, et al., 2023). This contributes towards inequities between Māori and non-māori within the current healthcare service. In order to reduce these disparities, Sewell (2017) expressed that having Māori health workers in healthcare practice is one way to ensure Māori are receiving culturally competent care. One clear indigenous solution in Aotearoa/ New Zealand is to increase the Māori health workforce. There is research regarding the need for more māori health professionals, however, little is known about why many Māori do not enter or complete study in health-related disciplines.

Methodology

Mihimihi

- Review of current literature

Whakawhanaungatanga

- Submission of ethics proposal to ensure the research is rigorous, honest and transparent

Kaupapa

- Recruitment of participants to carry out interviews using the Hui Process (Lacey et al., 2011).

Poroporoaki

- Data transcribing and analysis

- Dissemination of findings

Results/Findings

"I'm not smart enough, I'm not good enough"

"Being a single and māori mum, I want to study and work as well so I can feed my kids"

"Do I want to be a māori that's just like the rest of the western world you know do I you know, how can I be a māori in a space that wasn't made for me?"

"Am I strong enough in my māoritanga to or you know in myself to pursue a field that that's just killed us off in many ways you know"

"Like with going into healthcare, I am terrified to become a version of myself that I look at her you know and I hate her"

"When you remove people from where they belong, it causes a disconnect. Whenua is important to some people"

Conclusion

The findings illustrate key insights into barriers Māori parents face when entering health professional studies. Factors such as lack of financial support, confidence, racism and colonisation were highlighted from the powerful kōrero shared during the interviews. The project aims to set a foundation for further research and to aid in increasing māori capacity in health professions.

Acknowledgements

I would like to acknowledge and thank my courageous participants, Supervisors; William Kelton, Donna Foxall, Lisette Burrows and the Te Nehenehenui Trust. Thank you for your knowledge, guidance and support throughout this summer research journey. Ngā Mihi

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Wiapo, C., Sumi, L., Kusntron, L., Wilkinson, A., Burn, J., Cooper, R., & Adams, S (2023). From kaumātu to enrolled nurse: A successful workforce initiative to increase Māori nurses in primary health care. Nursing Praxis in Aotearoa New Zealand, 2023, 1-14.

Evaluation of Pasifika Primary Care Data

Valentina Papa, Lynne Chepulis, Sara Mustafa

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

Background

Type 2 Diabetes Mellitus (T2D) is a global epidemic and chronic condition affecting approximately 340,000 individuals in New Zealand, with Pasifika populations being disproportionately affected by T2D with rates of 15.8% compared to 6.3% for NZ European. Pasifika are one of the main ethnic groups affected by diabetes, diabetes-related complications, and avoidable hospital admissions.

However, Pasifika populations are underrepresented in research, both internationally and in New Zealand, by aggregating Pacific Island subgroups together, masking health disparities present among these heterogeneous populations. Therefore, our study aimed to characterise T2D and explore diabetes-related medication use among different Pasifika populations in primary care.

Methods

Data collected from four primary health organisations between February 1st 2021 – July 31st 2022 was analysed. Participants were included if they identified as Pasifika, aged 18 – 75 years and had T2D. Sociodemographic and clinical data were collected from the primary care records. Social deprivation data was collected from the Ministry of Health. Diabetes medication dispensing data were collected from the National Pharmaceutical collection.

Results

Pasifika Ethnicities

Median HbA1c for each Pasifika subgroup

Proportion of prescriptions for eligible patients

Proportion of patients at target HbA1c for each Pasifika subgroup
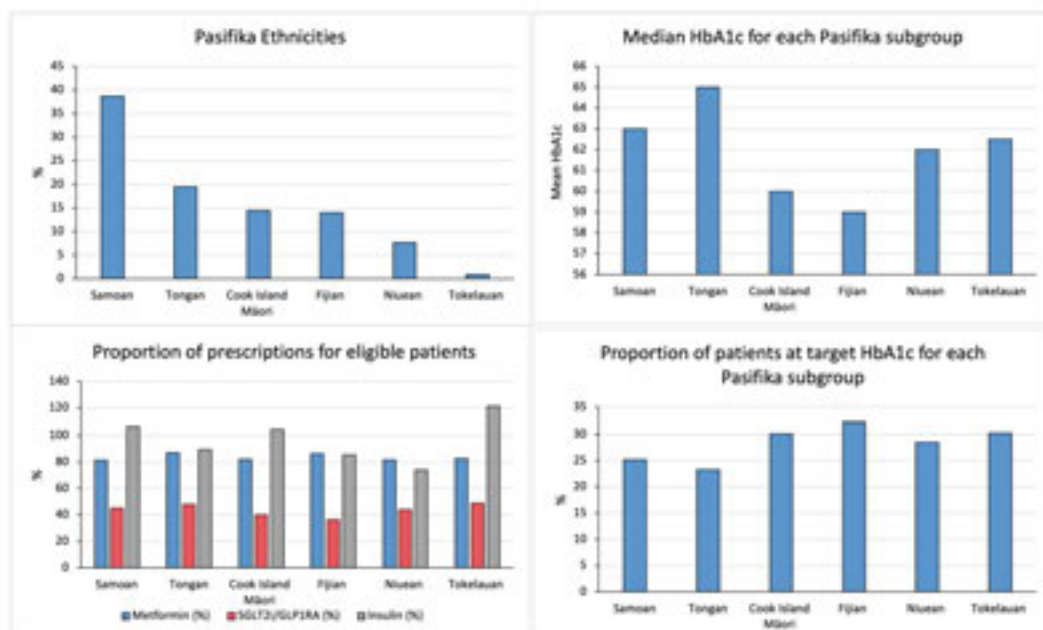
Extra findings:
- Data was collected from 10,414 patients
- Over half were aged ≥ 55 years, across all ethnicities
- T2D = females > males (52.29% vs 47.71%; $p = < 0.001$), across all ethnicity groups

Conclusion

Overall, there were differences in T2D characteristics and medication use among Pasifika ethnicities, something important to consider when delivering medical care to these populations. Only 28.8% of patients were at target for HbA1c, which was significantly lower in Samoan and Tongan groups, with the latter groups also having the highest mean HbA1c. Furthermore, ~80% of patients across groups were prescribed with metformin but SGLT2i/GLP1RA prescribing was low across all ethnicities, with Cook Island Māori and Fijian having the lowest prescription rates. Therefore, these differences highlight that is not always beneficial for studies to review these populations as a collective group.

Acknowledgements

Te Whatu Ora
Health New Zealand
Waikato

Te Aka Mātuatua – School of Science

Does size matter?
Exploring the role of binding surface in enzymatic ligation of Xeno Nucleic Acids

Aakashdeep Dutta, Supervised by: Dr Adele Williamson and Dr Elizabeth Rozska-Smith

Introduction:

Does the size of a ligase enzyme affect its ability to recognise and ligate nick DNA containing xeno nucleic acids?

SB duplex
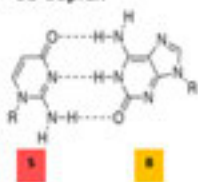
PZ duplex
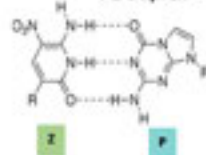
Xeno nucleic acids (XNAs) represent a class of nucleic acid analogues featuring chemically altered sugar groups.

LigA **LigE** **Lig4**
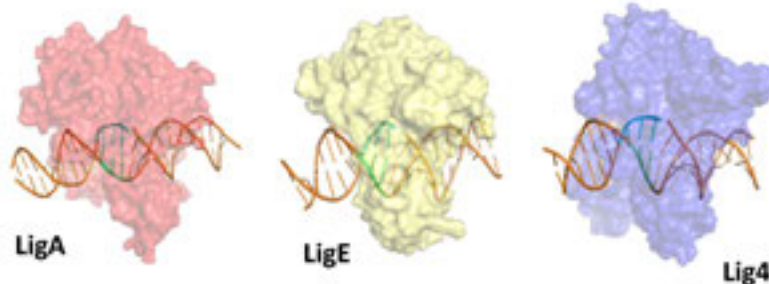
Fig 1. Bacterial DNA Ligases bound to a PZ duplex.

The overall **aim** of this research is to **recombinantly express and purify** DNA ligases with large domains (LigA, Hu-Lig I, Hu-Lig III and Ngo-LigA) and **test their ligation ability** on XNAs, using gel-based activity assays.

Methods:

Transformation in *E. coli*

Expressing Protein in *E. coli*

Protein Purification

Oligonucleotide ligation assays
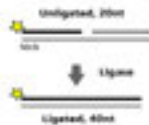
Results:

The DNA ligase enzymes; E.coli-LigA, Hu-Lig I, Hu-Lig III and Ngo-LigA were successfully transformed into *E. coli* BL21 (DE3) plysS and small-scale (50mL) expression trials showed soluble expression for *E. coli*-LigA and Hu-Lig I. Hu-Lig III and Ngo-LigA require further testing to improve protein expression.
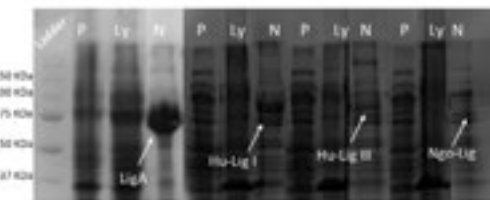
Fig 2. SDS-PAGE gel for the Nickel pull-down depicting expression of the proteins' LigA, Hu-Lig I, Hu-Lig III, and Ngo-Lig in *E. coli* BL21 PlysS. P=Pellet, Ly=Lysate & N=Nickel beads.

E. coli LigA was grown at a large scale (1L) and purified using protein chromatography. The purified ligase was then used in gel-based activity assay to test ligation on nick DNA containing natural base pairs (nick) versus XNAs.

A

UB Duplex 13
UB Duplex 14
UB Duplex 15

UB SB Duplex 2
UB SB Duplex 13
UB SB Duplex 14
UB Duplex 15

B

Nick ✓
PZ 13 ✗
PZ 14 ✓
PZ 15 ✗
SB 2 ✓
SB 13 ✓
SB 14 ✓
SB 15 ✗
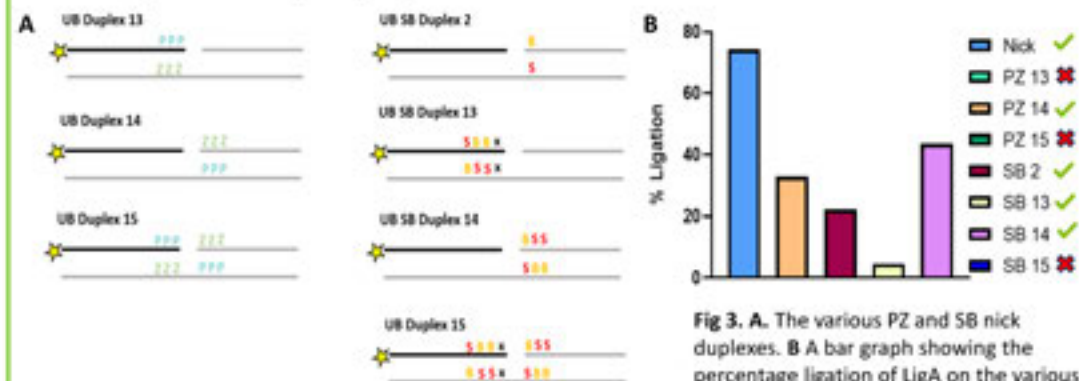
% Ligation

Fig 3. A. The various PZ and SB nick duplexes. **B** A bar graph showing the percentage ligation of LigA on the various XNA duplexes.

Conclusion and future work:

The LigA BL21 PlysS plasmids provided **quite good expression** and the oligonucleotide ligation assays were **successful**. However, the expression of Hu-lig I, Hu-Lig III, and Ngo-Lig requires further **optimization** to compare the ligases' percentage ligation.

References: Tu, T., Huan, S., Ke, G. et al. Functional Xeno Nucleic Acids for Biomedical Application. Chem. Res. Chin. Univ. (2022). https://doi.org/10.1007/s40242-022-2186-7

Unveiling the Moss-tical Wonders:
A Cacophony of Colours in Lichens and Bryophytes under the Near Infrared Spotlight.

Amanda Hassan,
Supervisors: Assoc. Prof. Chris Lusk, Assoc. Prof. Melanie Ooi

BACKGROUND

Cryptogams, such as bryophytes and lichens, crucially impact forest nitrogen balance, (Markham & Fernández Otárola, 2021).

There are substantial nitrogen losses in the form of Dissolved Organic Nitrogen in waterways, which should be impacting the productivity of the forests. (Hedin et al., 1995).

Nitrogen-fixing (Fabaceae) trees increase nitrogen availability, but what is happening in Fabaceae-scarce regions? (Houlton, 2015).

There is evidence in boreal forests that nitrogen-fixing bacteria associated with mosses may contribute to the unbalanced nitrogen budget (DeLuca et al., 2002).

To deepen the research in this field, there needs to be a deployment of non-invasive, rapid methods of identifying cryptogams.

The human eye perceives light within the range of 400 to 700 nanometers, whereas the Near-Infrared spectrum, spanning from 700 to 2500 nanometers, allows for enhanced data collection (Workman, 2023).

METHODS

Sampling:
Samples were obtained from Rocky Hill Road, Masterton (-41.1979, 175.7890) and Lake Okataina, Rotorua (-33.088, 176.431). In total, 71 cryptogams were collected: 40 chlorolichen, 17 cyanolichen, and 14 bryophytes.

Hyperspectral Imaging Setup:
We used a SPECIM FX17e camera in the near-infrared range (900nm to 1700nm), with 9 halogen lamp.

Data Processing and Analysis:
Involved a LUMO scanner software and an ENVI viewer interface for viewing.

Machine Learning Integration:
Data was broken down into training and test sets, then imported into MATLAB for training classical machine learning models. Models were tested against test dataset, with a confusion matrix and F1 score recorded to reflect success.

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RESULTS

Figure 4. Sample 1 Linear SVM prediction

Figure 5. Sample 1 camera photo.

Figure 6. Sample 2 camera photo.

Figure 7. Sample 2 Linear SVM prediction
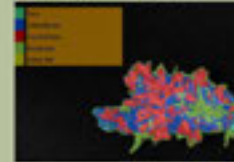
Figure 8. Confusion Matrix for Linear SVM Model.

78917	31580	14244	1844	498
1060	7123	151	5	1
2172	2446	20809	72	0
2704	8	385	2070	0
24	1	1479	251	597380

Confusion matrix columns and rows are as follows: chlorolichen, cyanolichen, bryophyte, bark, whiteref.

Results from machine learning model predictions from a mixed species sample: Linear SVM model F1 score of 0.6283.

The visual assessment determined that in these two samples, cyanolichen is incorrectly identified as chlorolichen.

The confusion matrix reported that cyanolichen is commonly misidentified as chlorolichen (31580). Bryophyte is also misidentified as chlorolichens (14244).

DISCUSSION

Initial machine learning results show moderate prediction accuracy across all non-vascular plant classes using near-infrared hyperspectral imaging. However, these findings, generated in controlled lab conditions, are yet to be validated in a dynamic field environment.

These results indicate that it may be possible to identify different groups of non-vascular plants with the use of near-infrared hyperspectral imaging and machine learning models.

Inaccuracies may arise from factors such as variation in sample growth stages and potential spectral overlap between chlorolichen and cyanolichen. Further testing and analysis are necessary, with potential expansion using a deep learning network, pre-processing of data and increased sample size for future experiments.

Figure 1. Chlorolichen
Chloro + Chloroplast based photobiont

Figure 2. Cyanolichen
Cyano + Cyanobacterial based photobiont

Figure 3. Bryophyte
Bryophyte + liverworts and mosses

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MARSDEN FUND
TE PŪTEA RANGAHAU A MARSDEN

ROYAL SOCIETY
TE APĀRANGI

ENVIRONMENTAL MICROPLASTICS

Caitlin Berquist, Megan Grainger, & Joel Rindelaub

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Introduction

Microplastics have been found in the worlds most remote regions and have also been detected in our food and drink.[1,2]

Microplastics measure less than 5 mm, nanoplastics are those smaller than 100 nm.[1]

Nanoplastics are able to enter cells and cross the blood brain barrier.[1]

There is uncertainty to human exposure and its health impacts.[1]

Aim

To develop a micro- and nanoplastic testing method for drinking water and atmospheric deposition samples.

Achieved by

1. Drinking water
- Water (MilliQ) from boiled and unboiled kettle
- Tea room (F1.09) tap and filtered water
- Tap water from lab (D3.12) and graduate student office (C3.05)
2. Atmospheric deposition: Hamilton and Raglan (sites below)

Figure 1: Sampling locations

Methods

Collect:
- 1000 mL water boiled and unboiled in Living and Co. 1.5 L plastic kettle.
- Samples and controls (MilliQ water) collected in triplicate where possible.

Water in
Vacuum pump
PCTE filter
Filtered water collection
Vacuum hose
Figure 2: Filtering apparatus

Filter:
Samples were vacuum filtered onto polycarbonate track etch (PCTE) filters (1 μm pore size).

Analyse:
- Optical microscope
  - water, airborne samples
- Scanning electron microscope (SEM)
  - kettle samples

Visual inspection - 37 mm filter

Microscope - 2.0 x 1.5 mm image
Particles > 10μm reported
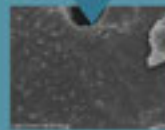
SEM - 3.2 x 2.4 μm image
Particles > 20 nm reported

Results

Plastic tea kettle
- Plastic tea kettle found to leach plastics into water regardless of temperature.
- Boiling lead to more and smaller particles suggesting heat degradation is a factor.
- Tea prepared using plastic kettle and/or teabags contains billions of plastic micro and nanoparticles.

Figure 3: SEM image of a filter containing MilliQ water from a boiled kettle
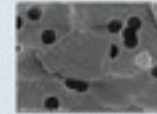
Figure 4: SEM image of a filter containing MilliQ water from an unboiled kettle

Campus drinking water
- Plastics identified by shape (fibres), colour, and size.
- Plastics found in tap water ranged <1 μm to 2.12 mm.
- Further work is need to confirm plastics via chemical analysis

Plastic counts and colours from manual identification
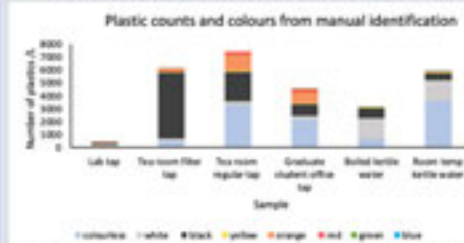
Figure 5: Plastics identified by microscope imaging (686 plastics/L background not removed)

Figure 6: Control sample filter (MilliQ water, top) compared to Grad student office (C3.05) tap water sample (bottom)

Average number of micro & nanoplastics in a single cup of tea:
>14.7 billion[2]

Average detected across campus drinking water
1691 MP/L
Particles above 10 μm

Whats next?
- Continued atmospheric deposition sampling in Hamilton and Raglan
- Use mass spectrometry (Pyr-GC/MS) to identify polymers and polymer additives
- Investigate risks airborne microplastics pose to humans

Figure 7: Atmospheric sampling units

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Diversity of Heat Stress Experiences in Lower-Latitude Cities

By Charlie Garcia Gil.   Supervised by Luke Harrington.

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INTRODUCTION

Extreme heat severely affects lower-income countries causing disproportional health impacts in vulnerable communities. This research is part of an international project that is developing affordable, sunlight-reflecting cool-roof coatings to help communities adapt to extreme heat. To be able to implement this, a thorough understanding of the temperature in each case study city is required. These cites are in Alofi, Niue; Hermosillo, Mexico; Ahmedabad, India; and Ouagadougou, Burkina Faso.

METHODS

The data was collected for each location using ERA5, which includes a mix of station and satellite data. The data collected consists of daily minimum and maximum temperatures taken from 1983 till 2022. The area spans a 25 by 25 km square over the respective locations. The analysis took place using the R language in RStudio using a variety of graphs to understand the data.

Seasonality

Tmax
Tmin

Hermosillo   Ahmedabad
Alofi   Ouagadougou
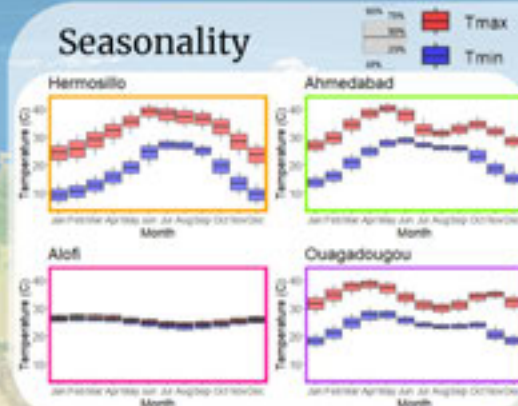
Figure 1: The temperatures regularly exceed 40°C on the hottest month of the year, tending to be pre-monsoon heat for Ahmedabad & Ouagadougou. High temperatures can persist for months in Hermosillo, while seasonality in Alofi is extremely muted.

Hermosillo, Mexico

Ahmedabad, India

Ouagadougou, Burkina Faso

Alofi, Niue

Influence of Hottest Month

All Data   May   April
June   February   95% line

Hermosillo   Ahmedabad
Alofi   Ouagadougou
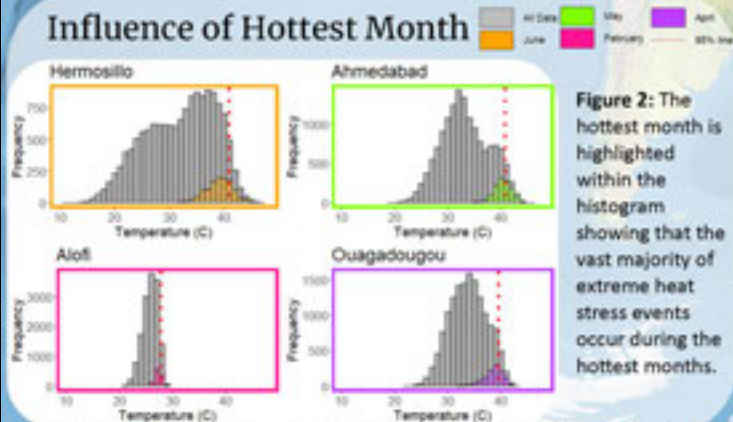
Figure 2: The hottest month is highlighted within the histogram showing that the vast majority of extreme heat stress events occur during the hottest months.

Range of Temperatures

95% line

Hermosillo   Ahmedabad
Alofi   Ouagadougou
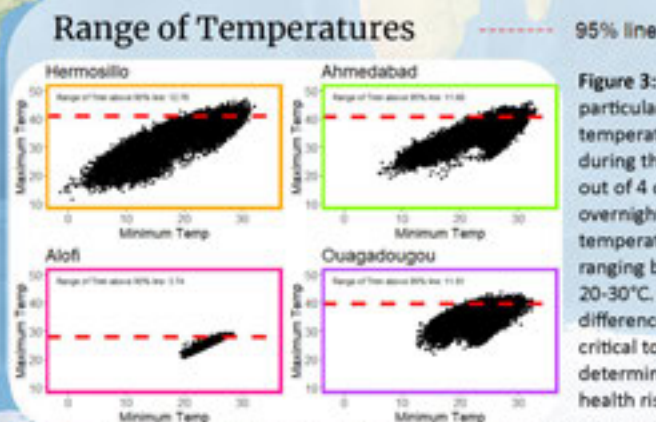
Figure 3: Despite particularly high temperatures during the day, 3 out of 4 cities had overnight minima temperatures ranging between 20-30°C. This difference is critical to determining health risks.

CONCLUSION

Each city had a clear seasonal cycle and a different hottest month. Periods of time with maximum temperatures above 35°C also showed significant variability in minimum temperature. This variability can be crucial to understanding health risks due to heat stress. Overall, Ahmadabad, Ouagadougou, and Hermosillo have similar experiences of extreme heat, while Alofi's heat experience presents differently.

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Microbial Communities of Waikato's Geothermal Environments

Student: Atareta Greeks
Supervisor: Adele Williamson

Background

❖ A rare and unique feature of New Zealand are the geothermal systems, 70 percent of them are in the Waikato Region alone.

❖ The micro-organisms in geothermic waters are believed to be closely related to the first organisms on earth.

❖ Some of these species are extremely valuable to science because of their ability to adapt to extreme temperatures and toxic environments.

❖ Many geothermal areas were developed before studies could be done, so very little is known about the uniqueness of these microbial communities.

❖ There is also increasing pressure to develop and use geothermic resources for energy and tourist attractions.

Objective

This study will focus on some of the small geothermic systems in the Kawhia and the Western Waikato areas, we will take 3-4 samples to establish what microorganisms live there. We expect to find bacteria, with some archaea, these will consist **Thermophiles** and some **Mesophiles** that have washed in from the surrounding areas. Because they are environmental microbes, once they are isolated, they do not grow very well.

Phylogenetic tree – we can also utilize the 16S sequence from our sample to create a phylogenetic tree, this is very similar to a family tree. This allows us to see how closely related the bacteria are to similar microbes living in the same environments.

Metagenomics- uses DNA sequences to find different microbes that may be in our samples. We will be looking for the 16S rRNA gene, there will be conserved parts (i.e. very similar between different species) and other parts that are divergent (i.e. very different). The divergent parts give off a kind of fingerprint that allows us to see what microbes are present .
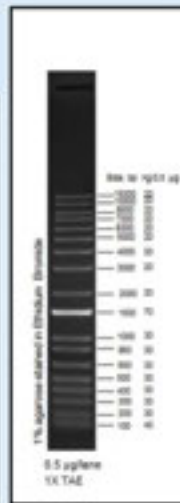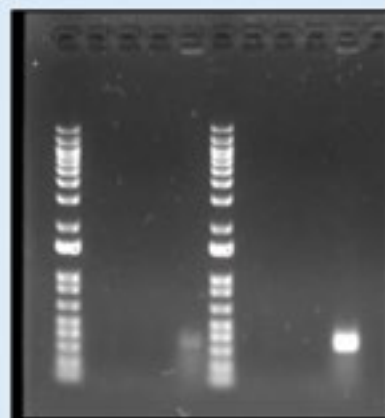
Results

There were small amounts of DNA in our sand samples from the Kawhia sand samples. Unfortunately, there was not enough concentrated DNA in our samples for it to be analysed. As you can see from our results the positive control has illuminated as well as a small band that is our water sample.

Conclusion

As stated earlier there is further research required to study the Microbes that thrive in Geothermic Environments throughout the Waikato. PCR rapid tests and Sequencing make these process faster. Like 1000 springs, we need to sample these areas before they are developed and create a phylogenetic tree with all the data from samples taken from these areas.

Methodology

STEP 1:
The first step is to take our samples from various sites.
Kawhia, Te Aroha and Okororie, samples are both water and sand samples.
These were taken at different depths and temperatures. Next, the water samples were filtered and collected DNA cells from the cartridge.

STEP 2:
To get a clean sample of DNA it is necessary to remove as much cellular debris as possible. To achieve this, we will be using the **Zymo Research Quick DNA Mini Prep Kit and the Powerlyzer Power Soil Kit**. This is a PCR – Quality DNA rapid method, to isolate microbes such as bacteria, fungi and algae etc. Once process is completed the DNA is ready for analysis.

STEP 3:
PCR amplifies template DNA and requires Primers, DNA Polymerase, Nucleotides and buffers. PCR involves heating to denature the DNA into single strands and lowering the temperature to allow primer to bind and then increasing temperature to allow polymerase to synthesize. Positive control is E.coli, Negative is EB buffer solution, Sand and Filtered Water sample. Used Thermocycler to run PCR reaction.

STEP 4:
Ran solidified 1% Agrose Gel in running tank . analyse DNA samples and our positive and negative controls. Remove gel from the tank and image using a V-Bright – nucleic gel. The V-Bright tests the concentration of the DNA in our samples. A company will be doing the sequencing procedure for us which will "read" the DNA in our sample, '16S amplicon sequencing' because it only reads the 16S gene, not all the DNA in the sample.

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TE NEHENEHENUI

HOW MISLEADING ARE PAST EXPERIENCES WHEN PLANNING FOR FUTURE RECORD-SHATTERING RAINFALL EXTREMES?

QUANTIFYING THE RARITY OF PAST EXPERIENCES WHEN PLANNING FOR FUTURE RECORD-SHATTERING RAINFALL EXTREMES, PROJECT #60

Authors
Research Student: Georgina Burgess
Supervisor: Dr L J Harrington
School of Science, University of Waikato
January 2024

INTRODUCTION

Record-shattering weather events are those which exceed previous long-standing records by significant margins.

Such extremes often have substantial social and economic impacts due to a tendency for systems and people to

adapt to the highest-intensity events experienced during a lifetime, but rarely higher. Recent examples in Aotearoa include flooding in Canterbury (May 2021), Marlborough Sounds (July 2021), Nelson (August 2022), Auckland (January 2023) and Hawke's Bay (February 2023).

Current assessments of extreme rainfall in Aotearoa comes with a quantification of uncertainty informed by the

full historical record at that location. However, the timing of extreme events throughout that record may influence how that uncertainty is interpreted. This project examines specifically extreme rainfall in various parts of the country.

This research project is dedicated to the analysis of extreme rainfall events in different regions of Aotearoa. We aim to better understand the nature and impact of record-breaking rainfall events and how their timing within historical records can shape our understanding of extreme weather patterns.

METHODOLOGY

We extracted and examined daily rainfall data from 21 high quality and long date range weather stations around the country using the National Climate Database (Cliflo). We quality checked the data by identifying outliers and untagged accumulations. We processed statistical and numerical analysis with MATLAB.

OBJECTIVE

To examine record-breaking weather events that have impacted different regions or not around the country throughout history.

We focus on

- Analysing rainfall data using cutting-edge techniques.
- Quantifying the rarity of extreme events over the decades.
- Informing our communities about our findings.

FINDINGS

We identified 127 severe weather events across different regions for the entirety of their station record.

%1 od these rainfall events had affected multiple regions concurrently or within days difference. The rarity of the event varies by event and region

We also ran some trend tests such a two tailed test to look at trends in the top percentiles of rain. We didn't find any significant trends.

ANALYSIS

Ashburton, Auckland, Chilton, Christchurch, Gisborne, Gaeaux, Hokitika, Kaeria, Mangana ae TV), Manawai, Nelson, Opiki, Orava, Paeroa, Queenstown, Ross, Raetara, Taweroaia, Springburn, Tarata, Trentham, Whakarewana 1900-2023
All indices are based on the baseline period of 1991-2020 & according to WMO Guidelines.

Extremely Wet Days Decade 2014-2023

TOP EVENTS

NEXT STEPS

More station data needs to be analysed as well as different duration intensities for different events.

Data homogenisation to undertake robust probabilistic analysis.

REFERENCES

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PEKAPEKA LONG-TAILED BAT

Boffa Miskell

Halle Aish

Supervised by Hazel Burridge & Grant Tempero

The Why
Implications & Impacts of research

Under the Resource Management Act (1991) and the Wildlife Act (1953), Chalinolobus tuberculatus is a protected species. The presence or absence of long-tailed bats must be determined before any construction projects commence to ensure impacts on bats are minimised and mitigated.

With increasing interest in developing renewable wind energy, bat mortality due to turbine strikes is more frequently occurring, posing a threat to endangered bat populations around the world. Studies conducted in North America and Europe have found that certain species may be more attracted to wind turbines and therefore are more at risk of incidents (Cryan & Barclay, 2009). Bats species that rely on trees for roosting are more susceptible to strike (Cryan & Barclay, 2009). C. tuberculatus is a tree roosting species. Understanding how our bats behave under different conditions is important to consider with wind turbine developments occurring throughout the country (Roemer et al., 2019).

Methodology
Measuring variable effects

Fig. Song Meter Mini Bat Ultrasonic Recorder (Wildlife Acoustics, 2020)

The region selected for this study was an area of farmland containing bush fragments north of Maungatautari mountain in the Waikato region of the North Island of New Zealand (37°58'S, 175°34'E).

Bat monitors were set out for 2-week periods at distances of 0m, 50m and 100m from the bush edge. Bat detections and ambient temperature were measured during the nighttime hours using the Song Meter Mini Bat Ultrasonic Recorder (Wildlife Acoustics, 2020) and wind measurements were taken every minute using the WindLog Wind Data Logger (Rainwise, n.d.) at these same locations. Data was analysed using Kaleidoscope Pro Analysis Software (Wildlife Acoustics, 2023) to draw out bat detections. Bat detections were then matched to wind and temperature data and trends in bat activity were observed using Microsoft Excel.

Background
Ecology of Chalinolobus tuberculatus

New Zealand has two extant species of bats, the lesser short-tailed and long tailed bat. Both are classified as Vulnerable - nationally declining (Bell, 1986). Globally, bats make up 20% of mammalian diversity, with 1/3 of all bat species at risk of extinction (Frick et al., 2020).

Chalinolobus tuberculatus (long tailed bats) are small, nocturnal bats (Sedgeley & O'Donnell, 1999), that are moderately fast flying, reaching speeds of up to 60km/hr (O'Donnell 2005). They are aerial insectivores that forage along forest edges and over water (Molloy, 1995, Sedgeley & O'Donnell, 1999). Long tailed bats commonly roost in the cavities of old trees and emerge at sunset (Griffiths, 2007, Sedgeley & O'Donnell, 1999).

C. tuberculatus were once widespread throughout NZ, but are declining due to loss of foraging and roosting habitat, predation by introduced mammals and human disturbance (O'Donnell, 2000a).

Long-tailed bat records

Fig. Locations of C. tuberculatus survey sites since 1990 (O'Donnell, 2000a).

Objectives
Factors influencing foraging activity

The foraging activity of Chalinolobus tuberculatus is influenced by several factors, varying significantly with habitat, season, time of night, temperature, windspeed, and invertebrate activity (O'Donnell, 2000b, Dekrout et al., 2014). The foraging tactics employed by long tail bats mean they have high energetic requirements (Griffiths, 2007).

- **Temperature** - Temperature is a key predictor for long tailed bat activity (Dekrout et al., 2014, Borkin et al., 2023).
- **Windspeed** - Higher windspeeds have a small positive effect on bat detection (Borkin et al., 2023). Long tailed bats may be active even when under strong wind (Griffiths, 2007).
- **Insect availability** - Invertebrate activity increases with temperature (O'Donnell, 2000b) and is a key predictor of activity (Griffiths, 2007).
  - **Vegetation density** - Bats prefer sites with sparser vegetation, having limited manoeuvrability under dense vegetation (O'Donnell, 2000b, Dekrout et al., 2014, Sedgeley & O'Donnell, 1999). Dense vegetation alters the reception of echolocation signals (Ober & Hayes, 2008).
  - **Artificial Light at Night** - ALAN may exclude bats from foraging areas, due to increased (perceived) predation risks (Scharnhart et al., 2023).

This study seeks to investigate the impact of wind speed and ambient temperature on bat behaviour.

Results

Ambient temperatures of 12-23.75°C were recorded over this study period. Bats were only detected between 13-21.75°C. A peak in bat detection occurred between 18-18.75°C, with 28.9% of bat detections occuring at these temperatures. The most common temperatures recorded during this study were between 17-17.75°C. Bats were rarely observed at temperatures below 14°C and above 21°C. This may reflect a low occurrence of these temperatures during the study period.

The majority of bat detections occurred on still nights. While only 47.4% of recorded windspeeds were <0.1km/h, 71.4% of bat detections were found at this windspeed. Bat detections dropped off to low levels at 0.1-0.9km/h. No bat detections were recorded at windspeeds above 11.9km/h, while 3% of recorded windspeed were between 11.9-24.9km/h.
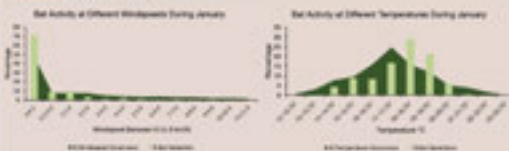
Figs. Results for bat activity at different windspeed and temperatures

Discussion

The results of this study suggest that Chalinolobus tuberculatus may tend to be more active foragers on nights with low wind speeds. These results contradict the results of a study done by Borkin et al (2017), which saw C. tuberculatus activity positively correlated with windspeed.

Our results also suggest that C. tuberculatus may prefer to forage on moderately warm nights. This follows trends predicted by Borkin et al., (2023) of increased bat detection on warmer nights, and the results of a Hamilton study done by Dekrout et al., (2014) which found strong correlations between bat activity and temperature.

These results are only preliminary, as the study is ongoing. To broaden the scope of this study, recordings could be taken over a longer period, throughout different seasons and at a wider range of locations. Dekrout et al., (2014) found bat activity peaked over the summer months and troughed in winter. Following this study throughout the seasons would allow us to observe and compare activity over a wider range of conditions. Our results may also be influenced by other environmental factors such as invertebrate activity or time of night.

References

Green Metrics: Mapping Canopy Cover for Sustainable Urban Growth in Tauranga

AUTHORS

Research Student - Jessica Mitchell from The University of Waikato, Bachelors of Climate Change.

Academic Supervisor - Margaret Barbour from The University of Waikato, Te Aka Matuatua, School of Science.

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Using LiDAR, near-infrared imagery and ArcGIS software, this project aimed to quantify the urban tree canopy cover boundary for the first time.

THINK OF A TREE AND ITS CANOPY NEAR YOUR HOME …

Has it been a safe space to run under when the rain falls? A place of shade on a hot summer day? Consider the wildlife that call that canopy home. Tree canopies release oxygen for us to breathe and they sequester a large amount of carbon dioxide!

Tree canopies keep us and many others alive, but as urban sprawl spreads across Aotearoa New Zealand are we making sure we keep them alive?

TAURANGA: A BIOPHILIC CITY
Where nature enriches, communities thrive, wellbeing flourishes

Tauranga City Council (TCC) has a Nature and Biodiversity Action and Investment Plan. One strategic goal of this plan is to aim towards creating a biophilic city. An action step to reach this goal is to measure, manage, and grow the tree canopy coverage across all suburbs.

This research is a first for TCC, and delivers on the goal to measure and understand the baseline of what the city's looks like to date, as they work towards a 30% coverage across the boundary.

WHAT ARE LIDAR AND ArcGIS?

Lidar stands for 'Light Detection and Ranging data' and is a remote sensing method that uses light in the form of a pulsed laser to measure ranges (variable distances) to the Earth [1]. This data is imported into ArcGIS (a geographic information system software application) to give you a map with billions of data points to work with (see graphic below).

3,391,372,667 LIDAR DATA POINTS TO START WORKING WITH …

CANOPY GOAL 30%

CURRENT CANOPY 22%

HIGHEST & LOWEST SUBURBS

WELCOME BAY EAST — 39%

WAIRAKEI CENTRAL — 4%

RESULTS

- Tree canopy cover across Tauranga = 22%
- Highest Main Suburb = Welcome Bay at 34%.
- Lowest Main Suburb = Papamoa Beach at 11%.

HOW DOES YOUR SUBURB RANK?

0 1.25 2.5   5 Kms

Tree Canopy Cover by Tauranga City Suburb

GOAL 30%

CURRENT AVERAGE 22%

34% | 32% | 32% | 30% | 30% | 29% | 27% | 26% | 26% | 26% | 24% | 24% | 24% | 23% | 23% | 22% | 17% | 13% | 11%
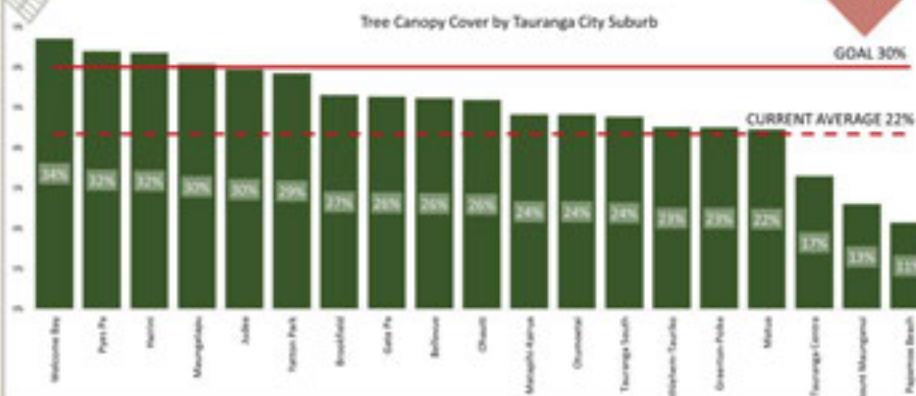
A TRIAL AND ERROR OF METHODS

INITIAL METHOD - Trialed Python Deep Learning model that was pre-trained to classify lidar data into New Zealand canopy data. This model failed and was abandoned.

METHOD NUMBER 2 - Image reclassification tool on near-infrared imagery. The processing time was extremely high and therefore this method was abandoned.

FINAL METHOD (Success!) - An array of ArcGIS geoprocessing tools (see full list to the left) and followed a number of steps:

1. **Clean up the Lidar dataset:** The 3.4 billion data points are auto-Classified, Great! However, these classifications can have errors, for example, tall buildings being classified as trees. Finding these errors and reclassifying them was a time consuming and manual process.
2. **Create top and ground raster datasets:** This used a tool called 'LAS dataset to raster', which created rasters of the top most lidar points and the ground points.
3. **Create canopy cover raster:** By subtracting the top and ground rasters from each other we are left with the canopy height and coverage data.
4. **Remove anomalies:** By removing all points below 0m elevation, above 80m elevation, any points not on land and any sitting within a building footprint.
5. **Add in other layers:** Adding in suburb boundaries and aligning the data points allows for better analysis.
6. **Export the data:** Export to Excel to perform various data calculations like average coverage by suburb (see graph to the left).
7. **Visualise:** Import the calculated data back into ArcGIS and use different symbology functions to create various maps and graphs to visualise the data.

NEXT STEPS

TCC's Urban Tree and Climate & Sustainability team will use this data to plan the continual improvement to canopy coverage for the city. Aiming for 30% canopy cover as well as assessing potential carbon insetting projects which includes planting of trees to reach the councils target of net greenhouse gas emissions by 2050.

REFERENCES

[1]. National Ocean Service. (n.d). What is lidar?
https://oceanservice.noaa.gov/facts/lidar.html#:~:text=Lidar%2C%20which%20stands%20for%20Light%20Detection%20and,about%20the%20surface%20of%20the%20Earth.

Mating behaviour and ecology of the fishing spider *Dolomedes dondalei*

Juniper Sprengers-Sanson & Chrissy Painting

Background

Dolomedes dondalei is a native New Zealand spider, found along riverbanks and streams.

The understanding of its mating system is currently unknown.

This project aims to initiate the exploration of the mating system of *D. dondalei*, providing a foundation for building knowledge on the evolution of mating behaviors in this unique species.

Methods

1. Habitat Identification
Conducted surveys to identify occupied habitats within the Waikato region.

2. Collection of Spiders
All spiders were observed and collected from 10-20th January 2024.

3. Observations of Ecological Characteristics
- Recorded and analysed age-related data of the spider populations.
- Documented sex ratios to better understand the demographic composition.

Preliminary results

Two locations were discovered within the Waikato region; Karakariki waterfall track and Te Aroha along the Tunakohoia stream.

We successfully gathered a sample population of the target spider species, where we observed 35 individuals, comprising 3 males, 11 females, and 21 juveniles.

Sex ratio of *Dolomedes dondalei*

Stacked bar chart titled "Sex ratio of *Dolomedes dondalei*", y-axis "Percentage" (0%–100%), x-axis "Location" with categories Te Aroha and Karakariki. Legend: Male, Female, Juvenile.
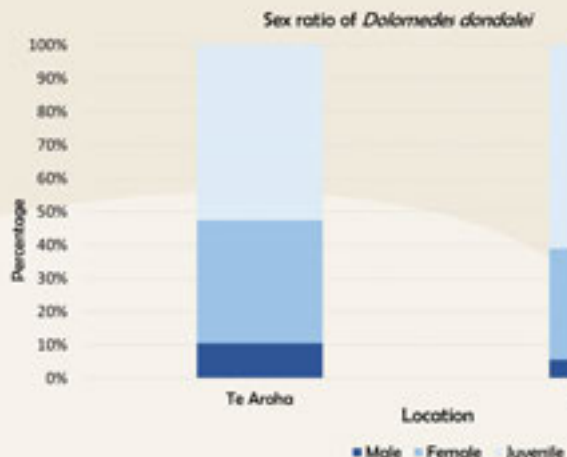
Discussion

Our analysis of sex and age ratio data indicates a noticeable decrease in the frequency of males compared to females during the latter months of the breeding season when observations and collections were made.

This observation suggests *D. dondalei* may be a monogynous species, exhibiting an initial male predominance followed by potential male mortality post-mating.

Future direction

Locating reliable sites to observe and collect the spiders in the Waikato provide a solid foundation for continued future research on the mating system of *D. dondalei*.

Our research will progress through the following stages.

↓

Conduct regular monitoring at multiple sites with measurements of the sex ratio, sexual size dimorphism and protandry.

↓

Conduct mating trials to observe and document mating behaviours, which could include female aggression, sexual cannibalism, and spontaneous male death.

↓

Finally, determine the mating system of *D. dondalei*, advancing our understanding of native arthropods and contributing insights into the evolution of extreme mating behaviour in animals.

Soil carbon cycling along geothermal gradients

Kelly Chow
Supervised by Louis Schipper
Special thanks to Seager Ray

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Introduction

- Soils contain the Earth's largest terrestrial carbon (C) reservoir so they play a pivotal role in balancing the carbon cycle[1].
- They absorb carbon dioxide (CO_2) from the atmosphere through plant photosynthesis and release CO_2 via root and microbial respiration.
- These biological processes are catalysed by temperature-sensitive enzymes[1] so the net response of soil C stocks to global warming remains uncertain (Figure 1).

Carbon dioxide in the atmosphere
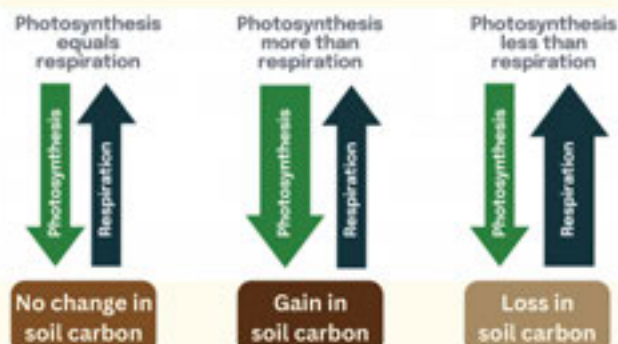
Carbon stored in soil organic matter

Figure 1. Potential scenarios under warming: soils act as carbon stores, sinks or stay the same.
[Adapted from NZAGRC (2023)[2]]

- Geothermal sites, characterized by natural temperature gradients, can serve as proxies for global warming's effects on soil carbon dynamics.
- This study focuses on two geothermal gradients (in Rotorua and Reporoa) to unravel the long-term influence of temperature variations on soil carbon stocks.

Method
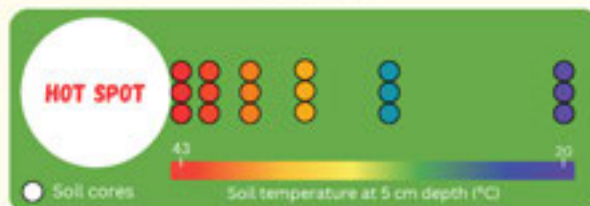
Figure 2. Sampling schematic - 6 positions representing a wide range of temperatures selected along each geothermal gradient

Soil core extraction: 3 replicates (41 mm diameter, 40 cm depth) collected at each position, bulked in 10 cm depth increments.

Temperature measurement: Thermometers inserted at 5 cm depth intervals (5 cm, 15 cm, 25 cm, 35 cm, and 45 cm)
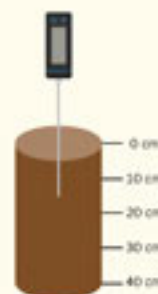
Sample processing: Soils were air-dried, sieved (2 mm), ground and ran through an Elementar combustion analyser for carbon and nitrogen contents (%).

C stock calculation: C stocks adjusted using equivalent soil mass correction.

Root biomass determination: roots were collected from sieve (2 mm), oven-dried and weighed.

References

[1] 1 Alster, C. J., van de Laar, A., Goodrich, J. P., Arcus, V. L., Deslippe, J. R., Marshall, A. J., & Schipper, L. A. (2023). Quantifying thermal adaptation of soil microbial respiration. Nature Communications, 14(1), Article 1. https://doi.org/10.1038/s41467-023-41096-x

[2] The science of soil carbon. (2021, March 29). New Zealand Agricultural Greenhouse Gas Research Centre. https://www.nzagrc.org.nz/domestic/soil-carbon-research-programme/soil-carbon-science/

Results
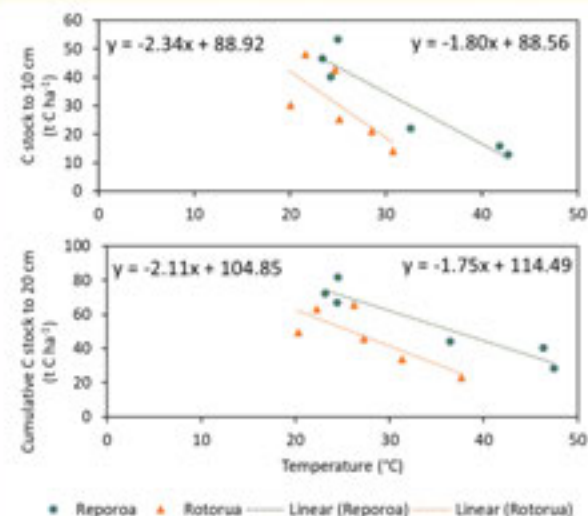
Figure 3. Average soil temperatures and cumulative C stocks for Reporoa and Rotorua soil samples, using ESM to 10 cm (top) and ESM to 20 cm (bottom)

Key findings:

- Soil C stocks to 10 cm and 20 cm depths both show similar decreases with warming:
- For every degree increase in soil temperature, 1.8 t C ha^{-1} was lost in Reporoa soils and 2.1-2.3 t C ha^{-1} in Rotorua soils.

Discussion and Future Research

- Rather than a one-off temperature measurement, annual temperature data loggers might provide better representations of the long-term temperature response.
- Further research needs to be carried out in more positions along the geothermal gradients and at other geothermal sites to validate our findings.

TAURANGA'S NOTABLE TREES

Researching and communicating the value of Tauranga City's urban forest.

By Lillian Balfour
Supervised by:
Margaret Barbour, UOW.
Stéphanie Keller-Busque
& Mark Armisted, TCC.

From one tree...

Background

Trees in urban areas are essential in the face of climate change. They are the city's precious carbon sinks, absorbing CO_2 from our atmosphere and storing it long term in their wood and roots (1). They also provide valuable ecosystem services - benefiting our economy, community and environment (2).

Trees managed by Tauranga City Council qualify as notable if they pass a certain threshold for cultural significance, or for its age, size, or contribution to the landscape.

Common name: English oak
Scientific name: *Quercus robur*
Age: 152 years old
Wood density: 0.61 kg/m3
Diameter: 1.74m   **Height:** 20m
Location: 664 Cameron Road

Total carbon stored: 2.1 tonnes

Annual carbon absorbed: 21 kg

1 Improves air quality. Filters out CO_2 and produces oxygen. (2)

2 Reduces heat. Provides shade and reduces surface temperature. (2)

3 Habitat for wildlife. Provides food and a home for birds and insects. (2)

4 Increases real estate value. Improves the aesthetic, privacy and functionality of outdoor spaces. (2)

In total, this oak has absorbed nearly 4 years of emissions from one average household car. (3)

To an urban forest...

Methods

- A tree's carbon stocks were estimated using the allometric equation from Beets et al. (2012), involving measurements of tree height, trunk diameter and wood density (2).
- Ecosystem services and potential communication strategies were researched and compiled in a literature review for the Tauranga City Council.

Key Findings: A carbon storage network

Being long lived and large, Tauranga's notable trees are more valuable as long-term carbon storage than as fast carbon removal.
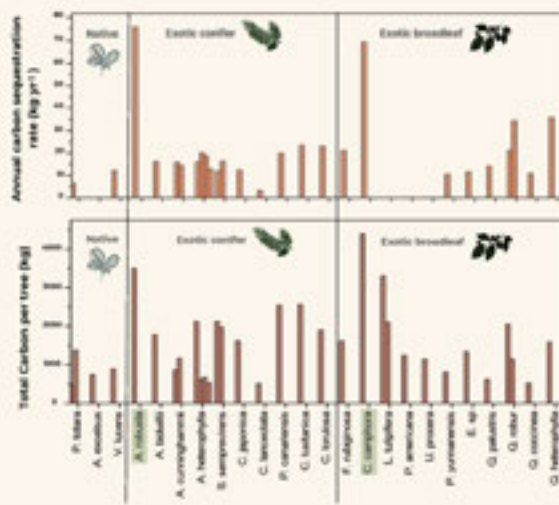
Highest total carbon stored:
4.4 tonnes by *C. camphora* (Camphor)

Fastest rate of carbon sequestered:
75kgs by *A. robusta* (Queensland Kauri)

To the Community.

When taking action to reduce emissions and respond to climate change, we need to protect our notable trees. They are active carbon sinks working alongside us and they provide cultural and natural significance to our city.

How can we communicate their value?

- Tell their stories: reconnect Tauranga's citizens with the cultural significance of these notable trees.
- Create engaging activities for children and families to interact with the trees.
- Increase awareness through improved signage and by including notable trees on the council website.
- Connect via cycle trails: scan the 2 Tonne Cycle Tour QR code to see the trail map and tour info.

The tour includes some of our most impressive notable trees. Each tree stores between 1.5 and 3 tonnes of carbon!

2 Tonne Cycle Tour
Scan the code to learn more!

References:
1. Climate Central, (2023). *Final report, the power of urban trees.*
2. Beets, et al. (2012). Allometric Equations for Estimating Carbon Stocks in Natural Forest in NZ. Forests, 3(3), 818-839
3. Ministry of Transport, (2015). Driver: New Zealand Household Travel Survey 2011 - 2014.

An Investigation into the Heat Tolerance of Invasive Blowflies

Margot Wilde and Ang McGaughran

Background

Invasive species impact New Zealand native flora and fauna, causing environmental and economic damage[1]. One factor that enhances invasion success is the rapid tolerance of invasive species to new environmental conditions[2,3]. This project looked at how invasive blowflies tolerate heat.

Aims

My aim was to explore the hypotheses that:

- More invasive blowflies have greater heat tolerance
- Blowflies in urban environments have greater heat tolerance than their rural counterparts

Methods

- Several blowfly species were collected at two sites (one urban, one rural) and transported to the University of Waikato.
- Blowflies were acclimated for two days in the lab (22°C, 12 hours light /dark cycle).
- Individuals were assayed at 41, 42 and 43°C, with their time to 'knockdown' recorded.
- ANOVA was used to determine differences in heat tolerance for five blowfly species in each environment.
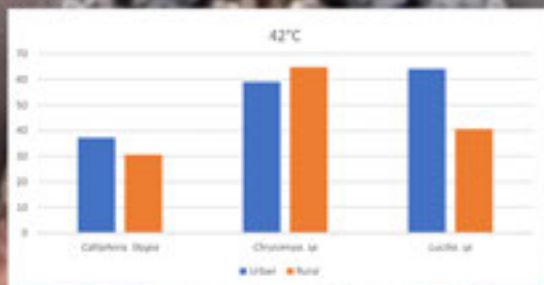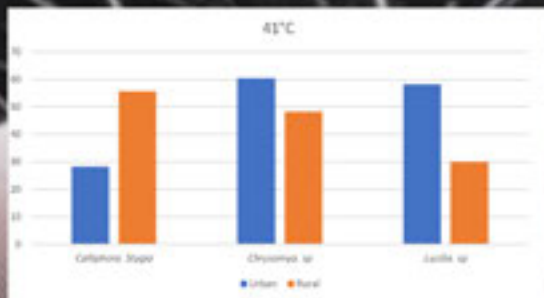
Figure 1: Average knockdown time for three of the blowflies species across the two environments. Invasiveness (geographic distribution) increases from left to right.

Results

- High variability in the number of flies assayed for each species, with low numbers in some groups
- Some indication that more invasive species (*Chrysoyma sp.*/*Lucilia sp.*) are more heat tolerant
- No definite trend that urban populations were more heat tolerant than rural

Outcomes

- Intriguing results that suggest differences in tolerance between blowflies of differing invasiveness
- Further investigation with higher sample sizes for some species/sites is required
- Future directions:
  - Compare results in a longitudinal study
  - Compare tolerance of blowflies measured directly in the field vs. in the lab following acclimation vs. in the lab following rearing for multiple generations

References

Wealti A. Climate change and its potential for altering the phenology and ecology of some common and widespread arthropod parasites in New Zealand. New Zealand Veterinary Journal. 2024;69(1):1-19.

Alonc JM, Peralta-Maraver I, Boninsoto F, Santos M, Rezende EL. Thermal tolerance in *Drosophila*: Repercussions for distribution, community coexistence and responses to climate change. Journal of Animal Ecology. 2022;91(5):677-87.

Kellermann V, Van Heerwaarden B, Sgro CM. How important is thermal history? Evidence for lasting effects of developmental temperature on upper thermal limits in *Drosophila melanogaster*. Proceedings of the Royal Society B: Biological Sciences. 2017;284(1855):20170447.

Invasomics Lab

Effect of alum dosing on the Utuhina Stream's ecology

Max McNamara & Dr Frank Burdon

INTRODUCTION

Nutrient enrichment causes eutrophication of lakes, which causes significant harm to ecosystems and the benefits they provide us. It is a growing problem globally and in NZ. In response to the eutrophication of Lake Rotorua, the Bay of Plenty Regional Council has taken actions to lower the Trophic Level Index of the lake. The Utuhina Stream which flows into the lake is being dosed with alum to reduce Phosphorus loads. This project is part of the routine monitoring to assess the impact of the dosing on the stream's ecology.

METHODS

- Surbers and Kicknets
  (Macroinvertebrates)
- Electrofishing
  (Fish)
- eDNA
  (Catchment Biodiversity)
- Cotton Strip Assays
  (Decomposition Rates)

Study design - One site above, one at and one below the dosing were sampled; both banks sampled.

RESULTS

This plot shows the macroinvertebrate taxa found in Surber samples. There were no significant differences in community composition between sites.
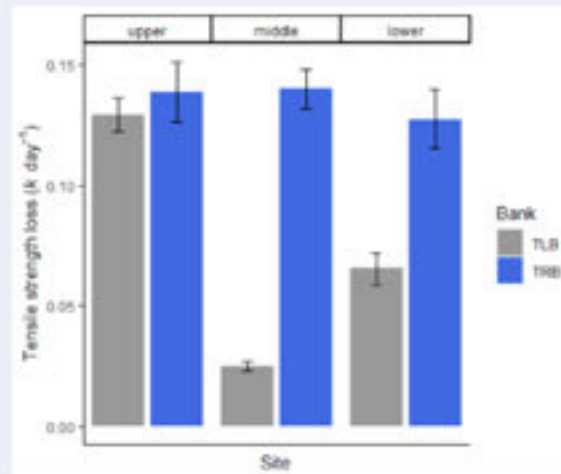
This plot shows decomposition rates at each site-bank. The alum is dosed at the middle-left bank. This significantly reduced decomposition rates below the discharge.

The eDNA and electrofishing results are still being analysed.

SUMMARY

The dosing did not affect macroinvertebrate composition, but did have local effects on decomposition rates. This shows the dosing is proving effective at lowering available phosphorus in the stream. Further research should assess the consequences for biodiversity.

CONCLUSIONS

Our results highlight the importance of using different biomonitoring tools to assess environmental impacts. Functional indicators like the Cotton Strip Assay can detect ecosystem impacts not shown by macroinvertebrates.

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Exploring Arylsulfatase Structure-Activity Relationships

Researcher   :   Melani Dabarera
Supervised by   :   Dr. Benjamin Dickson, Dr. Adele Williamson and Dr. William Kelton
School of Science, University of Waikato, New Zealand.

Background:

Arylsulfatases, such as Arylsulfatase A (ARSA) and B (ARSB), are essential for cellular homeostasis as they break down sulfate compounds within cells. The post-translational activation of these arylsulfatases relies on the formylglycine-generating enzyme (FGE) enabling them to hydrolyze sulfate esters[1].

The substrate tolerance and structure-activity relationships in the arylsulfatase family, particularly in the context of the metabolism of aromatic sulfates, are not well-explored. There is potential for use of this metabolism to trigger the cleavage of linkers in Antibody-Drug Conjugates (ADCs), a class of drugs designed for cancer treatment. ADCs rely on enzymatic metabolism of a chemical linker to selectively deliver toxins to tumor cells[2].

Although studies have examined crude sulfatase extracts, these sulfatases may demonstrate different substrate tolerance compared to human enzymes. Therefore, this study aims to produce recombinant ARSA and ARSB by co-expressing FGE in human cells to investigate their structure-activity relationships and gain a comprehensive understanding to develop sulfatase cleavable linkers.

Objectives:

To produce recombinant Arylsulfatase A (ARSA) and Arylsulfatase B (ARSB) in HEK293 mammalian cell lines by employing co-expression with the Formylglycine generating enzyme (FGE).

Methods:

Recombinant arylsulfatases were produced, purified and isolated using the below method[3].

1. Transformation- plasmids of FGE,ARSA and ARSB insert to E. coli cells
2. Culture the cells in agar plates
3. Select single colonies
4. Extract the plasmid DNA and measure the concentration
5. Transfect plasmids to HEK293 cells and harvest the proteins
6. Purify proteins from NGC chromatography
7. Identify proteins using SDS-PAGE electrophoresis

Results:

Type of plasmid DNA	Concentration (ng/ml)
ARSA	502.8±1.52
ARSB	897.7±1.38
FGE	962.5±1.26

Figures:
(a) Plasmid DNA concentrations after the transformations
(b) NGC chromatogram for ARSA+FGE/ ARSB+FGE coexpression
(c) SDS-PAGE gel image for NGC fractions run for ARSA / ARSB peak

- All three types of plasmid DNA had satisfactory concentrations to proceed with transfections.
- Concentrated bands appeared around 60 KD in the SDS-PAGE gel suggesting the presence of Arylsulfatase protein in the fractions collected from NGC chromatography.

Conclusion & future studies:

- Recombinant ARSA and ARSB were detected in the supernatant of HEK293 cells. However, due to their low concentrations, isolation of ARSA and ARSB from the supernatant is challenging.
- Isolation of ARSA and ARSB from the cell pellets will be done as the next step and concentration of the proteins in the supernatant and cell pellet will be compared.
- Purified proteins from the supernatant and cell pellet will be confirmed by protein assay.

References:

1. Appel, M. J., & Bertozzi, C. R. (2015). Formylglycine, a post-translationally generated residue with unique catalytic capabilities and biotechnology applications. ACS Chemical Biology, 10(1), 72–84. https://doi.org/10.1021/cb500897w
2. Bargh, J. D., Walsh, S. J., Isidro-Llobet, A., Omarjee, S., Carroll, J. S., & Spring, D. R. (2020). Sulfatase cleavable linkers for antibody-drug conjugates. Chemical Science, 11(9), 2375–2380. https://doi.org/10.1039/c9sc06410a
3. Jacobson, G. M., Kraakman, K., Wallace, O., Pan, J., Hennessy, A., Smietanki, G., Cursons, R., Hodgkinson, S., Williamson, A., & Kelton, W. (2023). Immunogenic fusion proteins induce neutralizing SARS-CoV-2 antibodies in the serum and milk of sheep. Biotechnology Reports, 38. https://doi.org/10.1016/j.btre.2023.e00791

Reef Fishes of Te Moana o Atawhenua Marine Reserves

BACKGROUND

- Marine Protected Area's (MPA's) are an important conservation tool used to maintain biodiversity around the globe, with each one falling somewhere on a range of low to high protection.
- Over time Aotearoa has implemented 44 marine reserves, with 10 highly protected no-take reserves located in Fiordland to protect in unique underwater environments (Figure 1).
- Aim: To assess long-term changes in fish biodiversity both inside and outside Marine Reserves within Fiordland Marine Area (FMA) using baited underwater video.

Figure 1: Map of Te Moana o Atawhenua Marine Reserves with relevant regions (Taumoana Five Fingers) labelled.

METHODS

- Three sample sites were selected in the FMA for monitoring of fish biodiversity inside and outside of established MPA's. Two sample sites were selected within the Taumoana (Five Fingers) Marine Reserve, one sample site was selected outside of it (Table 1).

Table 1: Site parameters of three selected fMonitoring sites in Fiordland.

Site	Protection Status	Habitat Type	# of replicates
Anchor	No protection	Sandy, between reefs	3
Cormorant	Protected	Sandy, between reefs	4
Peninsula	Protected	On reef	3

- Baited Underwater Video (BUV) frames (Figure 2) were deployed at each site at 12 - 15m depth. Video samples were captured with a minimum of 30 minute video from when the frame touched the substrate. This was repeated a number of times for replication.
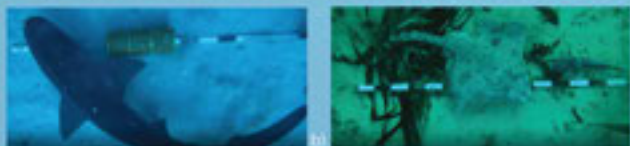
Figure 2: Screenshot examples of BUV frames deployed at each site, sevengill shark seen in screenshot a), rough skate and blue cod seen in screenshot b).

- Video was then analysed, consisting of observing a MAXCount of each species present within 30 second time intervals across the 30 minute sample for each of the replicates within the sites. Species richness and species diversity indices were calculated at each site.

SCAN ME FOR VIDEO CLIPS

RESULTS

- Species richness appeared marginally higher at both sites within the MPA, while no clear distinction could be made between protected or non-protected sites regarding diversity (Table 2).

Table 2: Species richness and diversity at each site.

Site	Species Richness	Diversity Index
Anchor	8	1.24
Cormorant	9	1.51
Peninsula	9	1.18

- Average abundance and total MAXCount of each species present was then tabulated, and plotted. N.B. for ease of viewing, only the six most dominant species across the three sites were shown here (Figures 3 - 5).

- Scarlet wrasse, blue cod, tarakihi, sevengill shark, school shark and butterfly perch were the most dominant species.

- All sites: Variation in fish assemblages was seen between the three sites, these differences may be attributed to the different habitats found at each site and each species ecological niche.

- Anchor vs Cormorant: The average abundance of every species except tarakihi was higher at Cormorant, with the total MAXCount values displaying the same pattern.
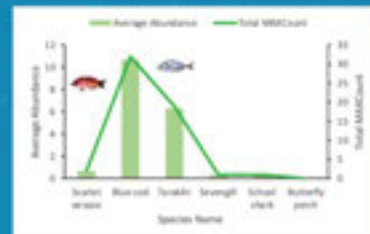
Figure 3: Average abundance and total MAXCount of 6 dominant species at Anchor site, Fiordland 2023.
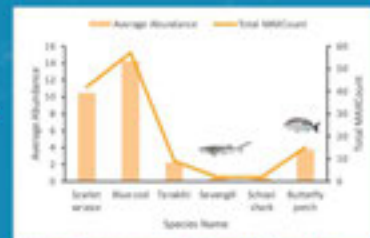
Figure 4: Average abundance and total MAXCount of 6 dominant species at Cormorant site, Fiordland 2023.
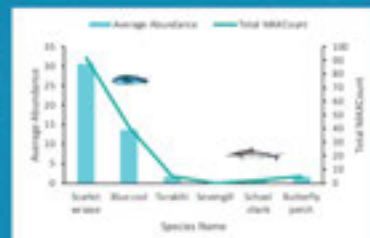
Figure 5: Average abundance and total MAXCount of 6 dominant species at Peninsula site, Fiordland 2023.

CONCLUSION

- The implementation of Marine Protected Area's is a key strategy for conservation of biodiversity but also for replenishment of commercially fished stocks that have been in decline, such as blue cod and tarakihi.
- Long term monitoring of MPA's is important to inform scientists and policy makers of the efficacy of a given MPA, and to advise for future MPA planning as to what criterion are needed for success.
- It is acknowledged that the existence of a successful MPA in a system can see increased populations not only within the MPA itself but in populations nearby due to principles of ecology such as immigration and emmigration. This is potentially the case in this brief look at Fiordland Marine Reserves for tarakihi.

Researcher: Mia Quinn
Supervisors: Dr. Jenni Stanley (UoW) & Richard Kinsey (DOC)
Acknowledgements: Dr. Josie Crawshaw & Jack Bowick (BOPRC)

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Department of Conservation
Te Papa Atawhai

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The Dirt on Nutrients, Disturbance and Biodiversity in Grassland Ecosystems

Nina Juby & Dr. Andrew Barnes
Te Aka Mātuatua, School of Science,
University of Waikato, New Zealand

What is DRAGNet?

DRAGNet is a global project that aims to identify and quantify the effects of and recovery from disturbance and elevated nutrient levels in herbaceous-dominated ecosystems. There are 3-5 blocks consisting of five treatment plots per site.

NPK	Control	NPK_DIST	NPK_CESS	DIST

Background

Application of nutrients and repeated disturbance (e.g. tilling) are common practices in agricultural grassland systems. They may impact community assembly and resilience. The impact on above and below ground fauna is not well understood.

Aims

- Understand the effects of fertilisation and disturbance on above and below ground biodiversity and food web structure
- Determine consequences of treatment impacts for ecosystem functioning (e.g. nutrient cycling, plant productivity)

Methods

10cm soil cores taken from each plot for mesofauna extraction using Macfadyen high gradient extractor

25g sieved soil taken from each plot for nematode extraction using Baermann-funnel extractor

Suction samples collected from each plot to identify and quantify above ground fauna

Predicted Results

- Lower abundance and diversity in plots that have been disturbed
- Few predators and short food chains due to low primary productivity in disturbed plots
- Reduced diversity in NPK treated plots

(1) NPK, (2) Control, (3) DIST, (4) NPK_DIST, (5) NPK_CESS

Manaaki Whenua Landcare Research

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Learning To Speak Bivalve:

Can *machine learning* automate classification of *infaunal behaviours*?

Researcher: Reuben Hattingh
Supervisors: Conrad Pilditch, Karyn Bryan, Nick Lim
Te Aka Mātuatua, School of Science, University of Waikato, New Zealand

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UNIVERSITY OF **South Carolina**

References

1 Introduction

Study species: *Macamona liliana*

Commonly referred to as the **'wedge shell'**, *M liliana* is a large, **deposit-feeding, tellinid bivalve** endemic to Aotearoa. [1]

The species is **numerically dominant** on many of New Zealand's **intertidal sandflats** . [1]

They prefers **sandy** sediments and lives **10-15 cm** below the sediment's surface. [1]

Why are they important?

Behaviours such as **feeding**, and **defecation** utilise **hydraulic mechanisms** to transport particles and fluids via inhalant and exhalent siphons. [1,2]

Resulting **pressure gradients** in the surrounding sediment cause **bioadvection** of **interstitial porewater**, governing **exchange** between **benthic** and **pelagic** systems and complex **biogeochemical cycles**. [2,3]

How do we study their behaviours?

Important behaviours are **hard to observe** while organisms are **buried** in the sediment.

However, since different behaviours generate **unique pressure signals**, activity can be monitored via **pressure sensors** as shown below. [1,4]

Adapted from McCartain et al (2017)
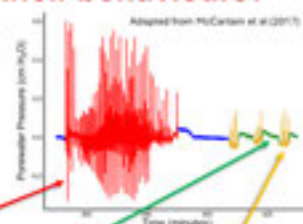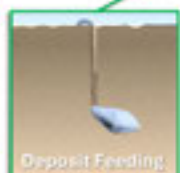
Burrowing   Deposit Feeding   Siphon Movement

2 Methods

Problem:
Labelling data for behavioural analysis requires watching hours of video footage.

Preprocess data → Train the model → Build a model → Evaluate model performance

Apply machine learning principles to create a user-friendly model which automates behaviour classification

Objective:

Long short-term memory (LSTM)

To label **porewater pressure signals** with the correct **bivalve behaviours**, a model must be trained to perform **time series classification (TSC)**. [5]

LSTM models are variants of **recurrent neural networks (RNN)** which utilise **gates** to capture **long range sequence dependencies** and learn from temporal data more **effectively**. [5]

Model architecture

INPUT LAYER
(X_train.shape[1], X_train.shape[2])

LSTM LAYER 1
(50 units, return sequences = True)

LSTM LAYER 2
(50 units, return sequences = False)

DENSE LAYER 1
(25 units)

DENSE LAYER 2
(units = y.shape[1], activation: SoftMax)

3 Results

Confusion Matrix Heatmap
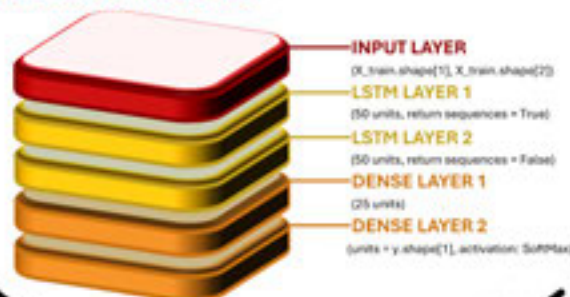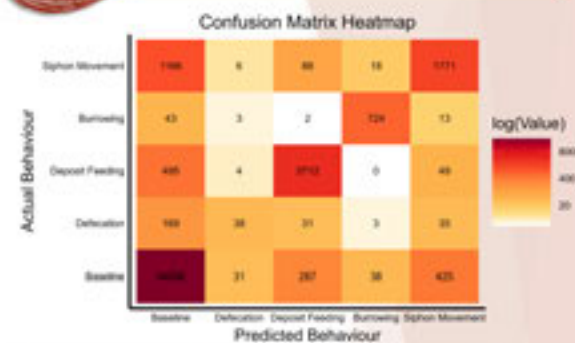
Behaviour	Precision	Recall	F1-score	Support
Baseline	0.95	0.98	0.96	35,479
Defecation	0.46	0.14	0.21	276
Deposit Feeding	0.90	0.87	0.89	4,260
Burrowing	0.92	0.92	0.92	785
Siphon Movement	0.77	0.58	0.66	3,049

The model demonstrates **highest accuracy** in identifying **baseline activity** but **struggles** with **defecation**, likely due to **class imbalance**.

While also performing well with **deposit feeding** and **burrowing**, the model tends to confuse **siphon movement** events for **baseline activity**.

Next steps

To improve the model's performance over all behaviours, **feature engineering** and **model optimization** will be explored, as well as using a **larger** and **more robust** dataset.

Acknowledgements

I must express sincere gratitude to **Conrad Pilditch** and **Nick Lim** for their invaluable guidance as project supervisors. Special thanks to **Sally Woodin** and **Dave Wethey** for providing critical data, and to **Lisa McCartain** for her assistance with data exploration.

Te Kura Pūkaha – School of Engineering

Cold-formed steel portal frames in fire

Alice Liu, Supervised by Prof. James Lim, Dr. Arthur Fang, Dr. Krishanu Roy
School of Engineering, University of Waikato, New Zealand

Background

Cold-formed steel is commonly used in the construction of low-rise residential and light industrial structures. Previously, two cold-formed steel portal frames underwent the full-scale fire test in Malaysia. A third test is currently in the planning stages, with the focus shifting to conducting a full-scale fire test on a two-story house.

Objective

This project aims to perform finite element modeling of the two-storey building and subsequently analyse it using SAP2000. The primary focus is on assessing how different temperatures impact the structural behavior, accomplished through comprehensive analyses with SAP2000. After the initial analysis, more detailed investigations will be conducted using ABAQUS.

Method

This two-story cold-formed steel building is designed using FRAMECAD. To analyse the impact of temperature, the FRAMECAD file is imported into SAP2000, then simplified for initial temperature analysis. Three load patterns (Dead load, Live load, and temperature) are applied in accordance with AS/NZS1170.1. Additional detailed investigations will be conducted using ABAQUS.

FRAMECAD design

Import to SAP 2000

ABAQUS model

Simplify model

Results

SAP2000 analysis indicates building collapse. Axial force results for initial situation confirmed that the structure after simplifying can be used for subsequent simulation tests. The results show that the change of truss is large between 50°C and 100°C, but the change is relatively slow from 100°C to 500°C. This indicates that collapse is expected to occur between 100°C and 500°C.

Due to SAP2000 only considers linear statics during analysis, a more detailed ABAQUS analysis is required to address potential errors.

Axial force diagram (Dead load pattern)

Shear results under dead load and temperature
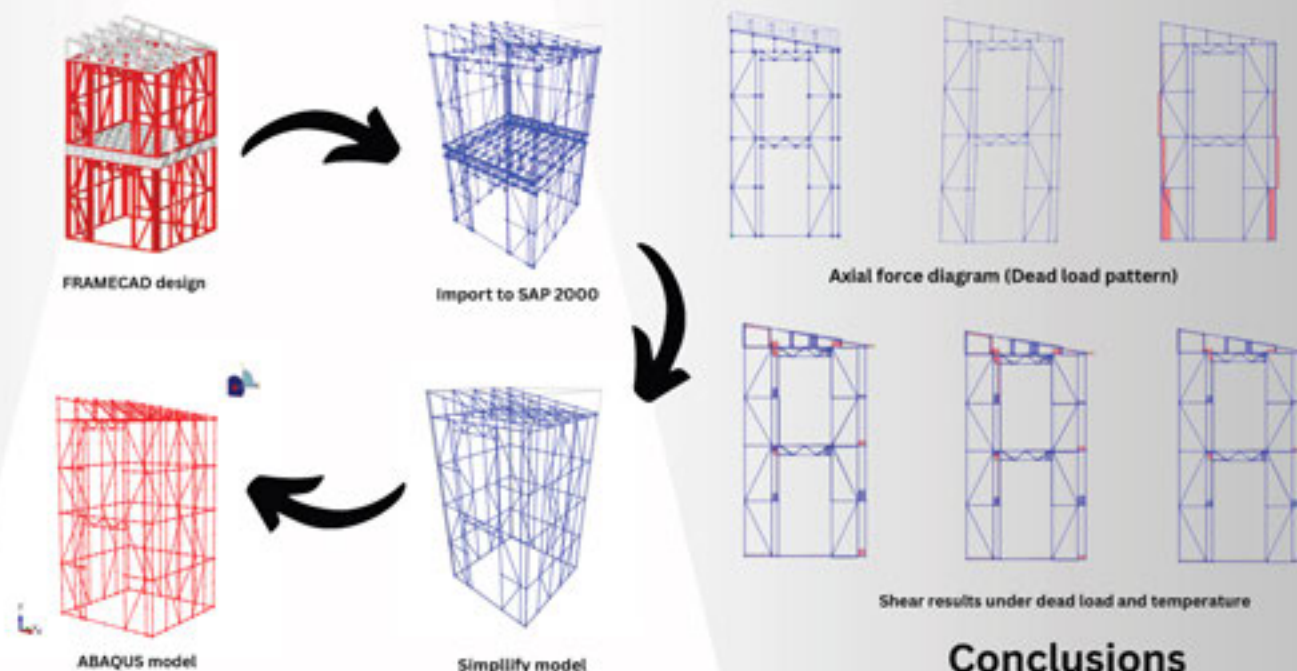
References

Roy, K., Lim, J., Lau, H., Yong, P., Clifton, G., Johnston, R., . . . Mei, C. (2019). Collapse behaviour of a fire engineering designed single-storey cold- formed steel building in severe fires. Vol.142, p.340-357.

Conclusions

After importing FRAMECAD files into SAP2000, significant time is consumed during the simplification stage due to software incompatibility.Despite the extended time required for SAP2000 simplification, the subsequent analysis was successful. However, because SAP2000 only considers linear statics during analysis, it is imperative to utilize ABAQUS for a more thorough examination of dynamic scenarios in future research.

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Mineral Magic
Treating Radiata Pine by Mineralization to form a Wood-Inorganic Composite

Exploring Alternatives to CCA treated timber

Research by Alis Bouma, supervised by Christian Gauss and Kim Pickering

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Intro - The Problematic Standard

CCA Treatment

Cr Cu As

Chromated-Copper-Arsenate (CCA) treated timber, with its characteristic green tint, is Aotearoas most effective exterior timber treatment.
Made from toxic chemicals and heavy metals, it works by poisoning fungi and insects before they can rot the wood - however, these toxic chemicals leech out, and meaning that instead of being recycled into paper or other wood products, it's thrown into a landfil.
This can cause carbon to be emitted, instead of locking it inside a useful product.
For the sake of the circular economy, we need something better.

The Alternatives

Calcium & Magnesium Carbonates

Mg Ca C O

These minerals form within the wood and displace moisture, and thus reduces the ability of fungi and insects to feed on it. Fire resistance is boosted too, as the energy for the fire is used to vaporize the minerals.

By carbon dioxide and using waste materials like seawater brine and recycled potassium fertilizer for magnesium, this method contributes to the circular economy greatly.

Mineralized Samples
Calcium Carbonate   Magnesium Carbonate

Magnesium Silicates

Mg Si O

Similarly, after treatment, magnesium silicates can create a hydrophobic and fire-resistant environment in wood. This makes it less appealing to fungi and insects.

The positives are its safety, as these minerals are often used in the food industry. The magnesium can again be sourced from recycled materials like seawater brine and potassium fertilizer.

Wet Mg Silicate Sample
Mineralized Samples

Periodic Table elements adapted from
Hamdya's drawing on Vecteezy.com
Mine ambient & Landfil.com from Freepik.com
Wooden Sword by InjectionVector on Freepik.com
Chain designed by upklyak on Freepik.com
The background image photographed by Trey Ratcliff, adapted.

Reference:
Read, D. (2003). Report on copper, chromium and arsenic (CCA) Treated timber. New Zealand: Environmental Risk Management Authority.

Treatment

1x or 2x Cycles

Drying 60°C | 24hr → Solution 1 (2-4hr Alternating Vacuum) → Drying 60°C | 24hr (Skipped for Wet process) → Solution 2 (2-4hr Alternating Vacuum) → Drying 60°C | 48hr

Variables

Solutions:
A: MgCl₂·6H₂O
B: CaCl₂
C: Na₂CO₃
S: Sodium Silicate*

Concentration:
L: 0.25M
M: 0.5M or 50%*
H: 1.0M

Process:
D: Dry
W: Wet

Treatments:
A → C (Ca Carbonates)
B → C (Mg Carbonates)
S → A (Mg Silicates)
A → S (Mg Silicates)

Characterisation & Analysis

After treatment, the sample is then passed through various machines;
- A scanning electron microscope (SEM) to image the sample.
- An X-ray diffractometer (XRD) to understand it's crystal structure.
- Thermogravimetric analysis (TGA) is done to test its fire resistance.
- Weight percent gain (WPG) is used to measure the amount of deposition.

Results

The magnesium silicate system had the highest weight gain, and thus is most likely to be an effective wood treatment, as tested.

Drying samples in between treatments had a profound beneficial effect on the WPG.

The magnesium silicates were particularly sensative to the order of treatments

Weight Percent Gain of each Condition

- Calcium Carbonates
- Magnesium Carbonates
- Magnesium Silicates

Overall best result: 64% WPG
No improvement with 2x cycles
Dry process significantly increases WPG
Best result: 8.5% WPG
Best result: 14.8% WPG

SEM - Magnesium Carbonates

Non-Uniform distribution of minerals within vessels
Magnesium Carbonate Deposits
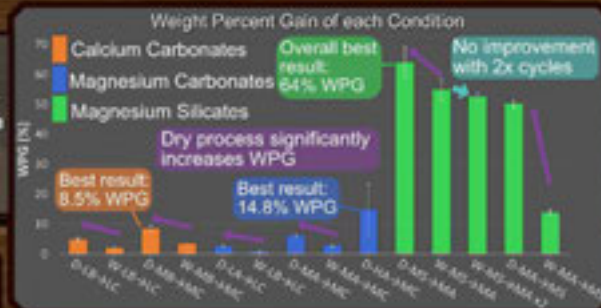
SEM showed signs of non-uniform magnesium carbonate deposits, largely within the vessels of the wood.

Calcium carbonate deposits were not observed.
The magnesium silicate samples have not yet been imaged

XRD

The magnesium carbonate treatment showed signs of the mineral *Chloratinite*

The calcium carbonate treatment showed signs both *calcite* and *vaterite*

XRD has not yet been done on the magnesium silicate samples.

TGA

TGA showed signs of slightly improved fire resistance in the carbonate systems.

What's Next?

Leeching tests to check stability of the treatments.

Exploration of other variables & chemicals.

Mechanical Testing & Dimensional stability

Reducing barriers to commercialization

"SUSTAINABLE CONCRETE USING GOLD-MINE TAILINGS"

PROJECT BRIEF

- Exploring the integration of gold mine tailings with concrete to create sustainable construction materials.

- This innovative approach will not only reuse waste materials but also reduce the environmental impacts of concrete production.

- Integrating these sustainable materials into 3D printing technology could also unlock new possibilities for eco-friendly construction practices [1].

LITERATURE REVIEW

Key Findings:
- Using 20% of mine tailings with the cementitious mix will improve workability of the mix [2].

Research Gaps :
- Insufficient research has been dedicated to studying the durability of the tailing and concrete mix.

OBJECTIVE

- The purpose of this study is to find the precise percentage of mine tailings that can be added to a cementitious mix so that the strength and workability are suitable for construction.

MATERIALS

CEMENT   MINE TAILINGS   SAND

EXPERIMENTAL INVESTIGATION

- A total of 6 samples per ratio were tested.

- Samples underwent compression tests, XRD, TGA, and SEM analyses for comprehensive results.

COMPRESSIVE STRENGTH

- Substituting 40% mine tailings for sand in compression tests exhibited higher strength compared to the control sample in concrete.

Table 1 : Replacement Ratio and Testing Days

Sand-Tailings Replacement	
Percentage (%)	28th Day Results (MPa)
Control	32
MT10	33.5
MT20	34.7
MT30	42.5
MT40	45.8
MT50	39.5
MT60	34
MT70	31.6

XRD

XRD - X-ray Diffraction
- The XRD results revealed an increased presence of quartz and ettringite in the analyzed samples.
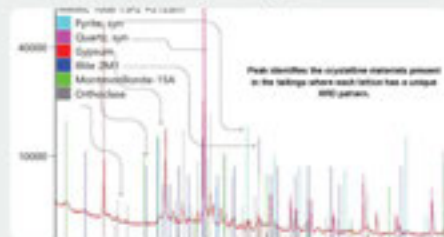
Figure 2 : XRD images of Mine tailings

TGA

TGA - Thermogravimetric Analysis
- The TGA results reveal that substituting 30% exhibited the fastest weight changes compared to other percentage variations.
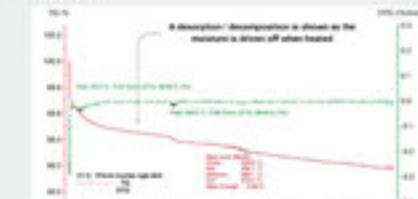
Figure 3 : TGA Image for 10% Sand replacement with Tailings

SEM

SEM - Scanning Electron Microscope
- The SEM images indicate that 30% and 40% substitutions have the highest presence of ettringites.
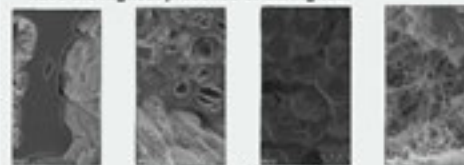
Figure 4 : SEM Images of Concrete with Tailings

3D PRINTING POTENTIAL

Tailings-cement blend for 3D printing is viable with ultra-fast initial (3 min) and final (5 min) setting time, and rapid hardening.

DISCUSSION

- Gradually replacing sand with mine tailings up to 40% enhanced compressive strength, with 40% substitution attaining peak strength. Nevertheless, it declined beyond 40%, compared to control specimens, during the 28th-day trend.

- Goldmine tailings can substitute sand in cement, but additional research is required for a comprehensive understanding of tailings.

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[1] Attaran, M. (2017). The rise of 3-D printing: The advantages of additive manufacturing over traditional manufacturing. *Business Horizons*, 60(5), 677–688. https://doi.org/10.1016/j.bushor.2017.05.011

[2] Álvarez-Fernández, M.-I., Prendes-Gero, M.-B., González-Nicieza, C., Guerrero-Miguel, D.- J., & Martínez-Martínez, J. E. (2021). Optimum mix design for 3D concrete printing using mining tailings: A case study in Spain. *Sustainability*, 13(3), 1568. https://doi.org/10.3390/su13031568

NAME : ASHMITA KUMAR

ID : 1555333

SUPERVISORS : KRISHANU ROY / KUSHAL GHOSH

Effect of different heat exchanger designs on heat transfer

Introduction

Ahuora is an organisation funded by the Ministry of Business, Innovation & Employment. Their goal is to decarbonise New Zealand's heating and energy sectors. One way to achieve this is by improving the efficiency of heat transfer between processes. This can be done by altering the design of heat exchangers.

Aim

Research alternative designs that could be used for heat exchange. Then investigate if any of these designs result in a greater amount of heat transfer.

Methods

- Literature Review
- 3D modelling in SolidWorks and Blender
- Learn how to perform Computational Fluid Dynamics (CFD)
- CFD test the 3D structures in ANSYS software

Designs selected

Two alternative designs were investigated. The first was a gyroid triply periodic minimal surface or (gyroid TPMS) structure. The other design investigated was a rhombus fractal structure.

Results

Both designs were tested and compared against a regular rectangular design.

Gyroid

Rhombus

Rectangular

It can be seen from the results that the rhombus fractal design gives the highest overall heat transfer.

Future Work

The next step in the process would be to physically produce the models. These models could then be tested and compared to the theoretical results. The models would be produced using a sintering process.

Researcher: Austen Cate
Supervisors: Timothy Walmsley
James Carson

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AHUORA

Nature Enhanced Heat Transfer

By David Dickson

Rationale for Research

Heat Exchangers are key to transferring heat energy in industrial processes. Biomimetics is applying the designs of nature to new technology. Designs which have already become optimized by environmental selection pressures. Biomimetics has been used before in designing other technologies and experimental heat exchangers.

To explore biomimetic design in heat exchangers, a method which can conveniently evaluate key performance metrics must be used. Computational Fluid Dynamics (CFD) can virtually simulate heat exchanger fluid flow and heat transfer to produce key metrics for comparison. CFD (specifically Ansys Fluent) is the primary tool of this research.

Introduction to Heat Transfer

Heat exchanger units are analysed on the principles of heat transfer. Heat transfer rate ($\dot{Q}$) by the equation $\dot{Q} = hA\Delta T_{LM}$ is the unit heat energy exchanged per unit time. Heat exchanger performance increases with h and A.

'A', is the surface area between the fluids exchanging heat. It is proportional to heat exchanger size, and the relative amount of heat transfer surface per volume. 'h', is the heat transfer coefficient. It is proportional to fluid thermal conductivity, mass flow, and turbulence.

The main problem in the pursuit of a higher area and heat transfer coefficient, is a greater pressure drop. This negatively impacts efficiency of a process system. Could a heat exchanger design, inspired by the patterns of nature, increase rate of heat transfer whilst sacrificing as little pressure drop as possible?

Methods

SolidWorks is the Computer Aided Design (CAD) software used to create 3D models of biomimetic designs for heat transfer applications. Biomimetic designs were applied to two distinct types of heat transfer units. Those being designs for pipe inserts (heat transfer between fluid and pipe surface) and heat exchangers (heat transfer between two fluids).

People have derived equations and numbers that produce patterns found in nature. Examples are equations for Triply Periodic Minimal Structures (TPMS) and the Golden Ratio $\phi = \frac{\sqrt{5}+1}{2}$. These equations and numbers provide the basis for developing designs that could enhance fluid heat transfer.

Ansys Fluent is the Computational Fluid Dynamics (CFD) software used to simulate and analyse virtual heat exchangers.

The general CFD workflow is as follows. Creating the 3D geometry (fig. 1a). Preparing the control volume by extracting volume from 3D geometry. Meshing the volume (fig. 1b). Simulate and analyse results (fig. 1c).

During the research, temperature and pressure readings from simulations were recorded across design iterations. These were recorded in excel spreadsheets that outlined the specifications of the geometry, mesh, and setup, and exactly what was iterated for each test.

A catalogue of documentation was also produced from this research. This includes tips and guides for CAD & CFD methods specific to this project. This documentation is intended to help future researchers continue this project.

Results and Conclusions

The nature of this research project has developed into the exploration of experimental designs, and the adaption of these designs for CAD & CFD. Lots has been learnt during this process.

As of current, the research has yet to reach comprehensive results. Research must continue for this project to produce useful results. The next step, once a viable design has been evaluated, is to physically model designs with selective laser sintering (SLS) technology.

If this research yields success, how would it impact industry? Having heat exchangers with higher heat transfer capacity per unit volume means they can be more compact. This allows processes which include heat exchangers (such as heat pump cycles) to be more easily retrofitted into the physical spaces of existing factories. As efforts for decarbonisation in industry escalate, retrofitting more efficient processes becomes more prevalent, and higher capacity heat exchangers more valuable.

(fig. 1, General CFD workflow.)

1.a   1.b   1.c

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AHUORA
CENTRE FOR SMART ENERGY SYSTEMS

Rainwater Capture at Tauranga City Council Sites
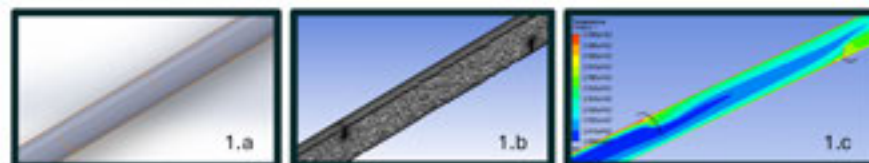
Problem

In Tauranga, water is primarily sourced from three spring-fed streams (Tautau, Waiorohi, and Waiāri) and treated at three major plants (Oropi, Joyce Road, and Waiāri), with a combined capacity of 90,000 m³/day. With a rapidly growing population, water demand peaks at 400 L per person per day in summer, averaging 300 L, stressing the city's water resources. The City Council recognizes the need for sustainable water management strategies amidst this growth and the challenges posed by climate change.

Methodology

The initial phase of the Tauranga City Council (TCC) project involved a comprehensive desktop study of approximately 400 properties, resulting in the selection of 7 suitable sites for rainwater harvesting (RWH) systems, with one earmarked for a rainwater storage tank educational display. The second stage, crucial for its detailed analysis and calculations, involved evaluating Tauranga's average annual rainfall over the past decade, estimating potential rainwater collection volumes, and calculating water consumption at these sites. The final stage focused on creating a 3D SolidWorks model of the Greerton Library as a potential educational exhibit to demonstrate a fully functional RWH system, facilitating stakeholder feedback and design refinements. Furthermore, analyzed the cost-effectiveness of installing Rainwater Harvesting (RWH) systems in New Zealand and the potential savings in annual water rates.

Educational Site

Key Selection Reasons

- High Traffic Vicinity
- Efficient Roof Design
- High Water Consumption
- Suitable Installation Area

Design Outcomes

Water Rates per year: $644.06

Saving in Water Rates per year: $251.18

% of Annual Water Rate Savings: 61%

Time to Repay (RWH System): 18 years

% Reduction in Pressure on Water Supply Infrastructure: 38.07%

Data Outcomes
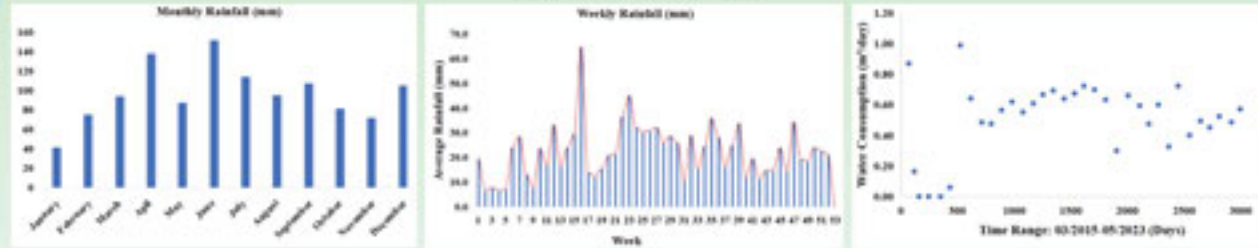
Average Rainfall Over the Past Decade (From 2013 to 2022): 1168.09 mm/year

Average Water Consumption (Meter Reading Spans from 2015 to 2023): 3.57 m^3/week

Weekly Water Consumption (Toilets & Gardening): 1393.9 L/week

Rainwater Captured (Roof Area x Average Annual Rainfall x Runoff Factor): 24.2 m^3/week

Total Litres of Rainwater Captured: 24219.13L/week

Design Solutions
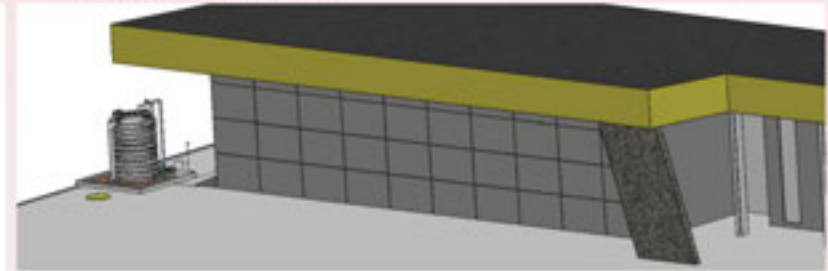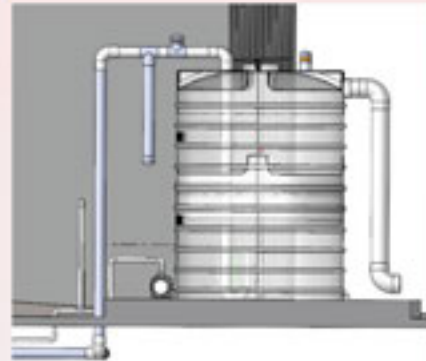
Model Description

The rainwater harvesting system at the Greerton Library efficiently collects rainwater via the existing gutters and downpipes, subsequently redirecting it to a storage tank.

RWH System Model Flowchart

Designed by Jinghao Cao   Supervised by Dr. Mark Lay & Stéphanie Keller-Busque   School of Engineering, Univeristy of Waikato & Tauranga City Council
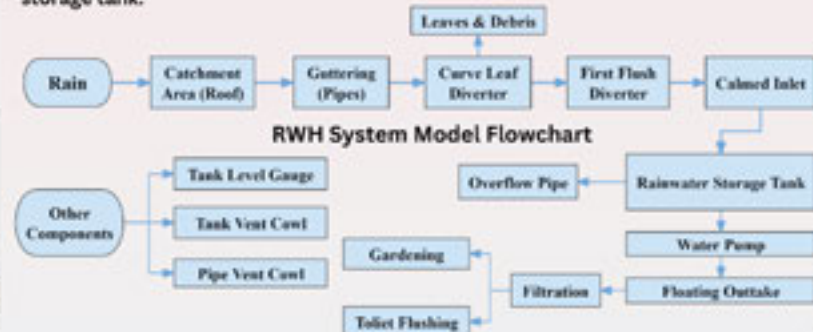
Selective Blueberry Harvesting

Rotary encoder
Actively counts rotations so shaking RPM can be calculated

PID controller
Varies PWM signal to BLDC motor to maintain shaking RPM

Profile Switches
Choose shaking RPM and applied time

See More

Introduction

Automated harvesters are unsuitable for the New Zealand fresh blueberry market as they damage fruit and are expensive.

Localised shaking of berry clusters is a step to improved automation, being relatively inexpensive and having low damage rates. One issue with shaking is it can remove unripe blueberries which don't ripen after harvesting.

Ripeness

Aim

The aim of this project is to modify a handheld shaker to have discrete shaking profiles and find the optimal shaking revolutions per minute (RPM) and application time (T_a) to remove only ripe blueberries.

Pulling the trigger, the shaker head oscillates the blueberry cluster, shaking the berries off

Method

12 combinations of RPM and T_a were each tested on 4 blueberry clusters.

- Test RPMs: 800, 900, 1000, 1100
- Test T_a: 1s, 1.5s, 2s

Ripe and unripe berries in the cluster were counted before and after shaking. The data was then analysed using a multi-variable regression with RPM and T_a as explanatory variables.

Results

The results were plotted into two graphs: Detachment accuracy (a value indicating the ability to harvest **only** ripe blueberries) and Detachment Efficiency (a value indicating the ability to harvest **all** ripe blueberries), against RPM and T_a. Common optimal settings could then be obtained.
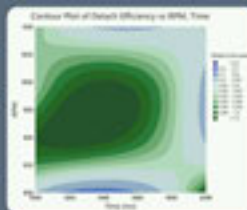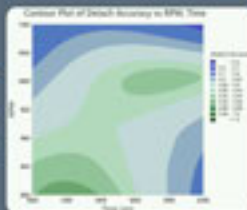
Discussion

Shaking RPM and time affect detach accuracy and efficiency. From the regression analysis, the optimum combination is:

900 RPM for **1.55 seconds**
Detach Accuracy: **93%**
Detach Efficiency: **100%**

There is high variability associated with the multi-variable regression due to a small sample size.

Conclusion

This study has shown that precise control over shaking profiles can improve harvesting performance. Further investigation should be done into how other variables like shaker position and time of year affect detach accuracy and efficiency.

Eventually, these shakers can be used in autonomous systems to retain fruit quality while still increasing harvesting rates.

Design: Jonathan Pearse, Samuel Hodder

Supervisors: Ben McGuinness, Alicia Sim

MaaraTech

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Human assist Technology for Blueberry Harvesting

Research by Kaio Lart, Supervised by Ben Mcguiness & Nick Pickering

Introduction

The increase in agricultural automation underscores the pivotal role of the vehicle itself. While significant amount of effort has gone into re-fining control algorithms, like differential drive systems, there exists a noticeable gap in the optimization and understanding of vehicle design and requirements. A comprehensive grasp of the performance and capabilities of these vehicles is crucial for their effective enhancement. Skid-steer vehicles have gained popularity due to their simplicity in construction. However, theoretical modeling proves challenging, given the intricate wheel-terrain interface where lateral wheel slippage is essential for turning. This research seeks to address this gap by ex-perimentally determining the requirements and performance character-istics of such vehicle

Objective

The objective of this research is to determine the mechanical power and torque requirements for a skid-steer orchard vehicle, considering factors such as track width and its impact on vehicle performance, including torques required and maneuverability. Additionally, the study aims to investigate the influence of motor operating speed and torque on motor efficiency, particularly in scenarios where two speeds are employed – a super slow harvesting speed with potentially lower effi-ciency and a faster transport mode speed. The obtained data will be compared to a digital twin to enhance the accuracy and reliability of the Model.

Method

The requirements of the motors will be analyzed by adjusting the track width, ground inclination, ground speed, turning differentials be-tween motors and vehicle mass. Data such as; battery and motor current and voltage, angular velocity, electrical motor power, turning radius (based on gps and local measurement) will be recorded to un-derstand the motor requirements of a skid-steer vehicle. This will be done by using ROS2 and Ardiuno to capture data during testing.

Results:

Testing is scheduled for the week of the 5th of Feb

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Bringing New Worlds to Engineering Students Without Leaving the Classroom

Bridging the Gap with Mixed Reality: Integrating Software and Technology as Innovative Resources in Civil Engineering Education

AUTHORS

Summer Research Student:
Aimi Wang
Proudly Supervised By:
Dr. Arthur Fang And Pro. James L.
Civil Engineering, School of Engineering

AFFILIATIONS

THE UNIVERSITY OF
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04. Results/Findings

The transformation of Finite Element Analysis (FEA) data for Mixed Reality (MR) applications includes additional steps for design refinement and compatibility across various platforms:

- **Importing into SolidWorks:** The WRL file can be imported into SolidWorks, renowned for its CAD and CAE capabilities, to make further design modifications based on FEA results.
- **Conversion to FBX via Blender:** Alternatively, the WRL file can be imported into Blender, an open-source 3D creation suite, for conversion to an FBX file. This format, widely used for 3D graphics exchange, requires scale adjustments during export to ensure accurate representation in MR environments.
- **Utilizing the FBX File:** The final FBX file is highly adaptable, compatible with a broad spectrum of 3D modeling software and websites such as Unity, Unreal Engine, Sketchfab.com, and Campfire3D.com. The FBX format's compatibility with these platforms, extensively used for creating immersive MR experiences, makes it an ideal choice for MR applications.

05. Analysis and Practices

The outcome of the project is manifested as a highly interactive and visualised structural model.

- **MR Glasses Integrated with Real-World Structures**
  - Comparative Visualization: Users can compare a virtual bridge model directly with a real-world bridge using MR glasses, enhancing understanding of structural designs.
  - Material Modification and Removal: Interactive features allow users to change or remove materials of bridge elements, offering a hands-on experience in structural engineering.
  - Collaborative Interaction: Enables simultaneous interaction with the same model between MR glass users and computer users, fostering collaborative learning and design.
- **Integration with FEA Models:**
  - Barcode Scanning for Model Presentation: Users can scan a barcode to display FEA structural models through MR glasses.
  - Model Manipulation: Allows users to turn and view the model through MR glasses, providing a comprehensive perspective.
  - Buckling Analysis Visualization: Users can play buckling analysis videos while simultaneously overlooking the model, offering a multi-dimensional learning experience.

Local buckling in FEA VS Local buckling in MR

Overall buckling in FEA vs Overall buckling in MR

01. Introduction

In civil engineering education, the integration of software and technology, as noted by Young et al. (2012), has not been fully explored in literature, especially in enhancing traditional teaching methods. This study addresses the gap in research on the application of VR/AR technologies for improving the understanding of civil engineering structures.

- Traditional methods like slides are limited in depicting complex structural behaviors.
- VR offers immersive 3D visualizations, clarifying intricate aspects like stress and strain in structures.
- Interactive VR enhances student comprehension and retention of civil engineering concepts.

02. Objective

This study investigates the integration of Mixed Reality (MR) technology in civil engineering education at the University of Waikato, focusing on structural analysis, buckling, design, and real-time Finite Element Analysis (FEA) for undergraduates.

03. Methodology

This research emphasizes the advancement of Mixed Reality (MR) in engineering, focusing on user-centered design, practical field testing, and comprehensive training:

- **User Experience Design:** Tailoring MR tools to be intuitive and beneficial, incorporating ergonomic and interactive features to enhance user engagement and comprehension.
- **Field Testing and Feedback Loops:** Deploying MR solutions in real-world engineering scenarios to gather user feedback and performance data, continuously refining tools based on practical insights.
- **Training and Skill Development:** Developing training modules to equip engineering professionals with the skills to effectively utilize MR in design, assembly, and maintenance operations.

06. Conclusion

In summary, converting FEA data into an MR-compatible format entails a series of methodical steps that bridge the gap between detailed engineering analysis and the immersive visualization capabilities of Mixed Reality. This process not only facilitates the visualization of complex engineering data but also lays the groundwork for further design modifications and interactive presentations in MR environments.

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A SUMMER RESEARCH POSTER BY LACHLAN BROWN

INFRA-RED INSIGHTS

With special thanks to Rachael Tighe, Larissa Kapf and Denis Jovan

OBJECTIVE

IN INDUSTRY IT IS IMPORTANT TO BE ABLE TO DETECT DEFECTS IN A MATERIAL TO ENSURE THE STRENGTH AND INTEGRITY OF A STRUCTURE.

NON-DESTRUCTIVE EVALUATION METHODS (NDE) ARE USED TO DO THIS.

WE WANTED TO INVESTIGATE USING THERMO-ELASTIC STRESS ANALYSIS (TSA), A NDE METHOD, TO MONITOR THE STRENGTH OF WELDED JOINTS IN MOTORSPORT CHASSIS.

FIG.1 WESMO PROJECT

WHAT IS TSA?

TSA USES INFRARED CAMERAS TO OBSERVE SURFACE TEMPERATURE GRADIENTS ON STRUCTURES AS THEY ARE CYCLICALLY LOADED. THE THERMAL DATA IS PROCESSED TO REVEAL STRESS CONCENTRATIONS WHICH CAN INDICATE DEFECTS IN THE MATERIAL.

FIG.2 THERMAL CAMERA

HOW DO WE TEST THE METHOD?

SHAKER PLATE EXPERIMENT:

USED A VIBRATION GENERATOR ON AN ALUMINUM PLATE, CAPTURING THERMO-ELASTIC RESPONSES WITH AN IR CAMERA AT VARIOUS FREQUENCIES. ANALYZED IMAGES IN MATLAB TO UNDERSTAND STRESS PATTERNS AND THEIR RELATION TO LOADING FREQUENCY.
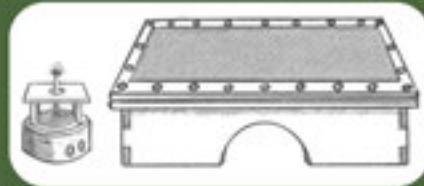
FIG.3 SHAKER PLATE SETUP

RESULTS

Our study revealed that loading frequencies below 50% of the sampling frequency are optimal for obtaining clear stress patterns in TSA.
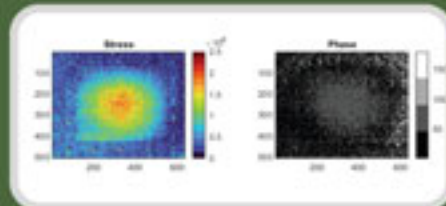
FIG.4 SHAKER-PLATE STRESS MAP

DYNAMIC TENSILE TESTING:

IN INDUSTRY IT IS IMPORTANT TO BE ABLE TO DETECT DEFECTS IN A MATERIAL TO ENSURE THE STRENGTH AND INTEGRITY OF A STRUCTURE. NON-DESTRUCTIVE EVALUATION METHODS (NDE) ARE USED TO DO THIS. WE WANTED TO INVESTIGATE USING THERMO-ELASTIC STRESS ANALYSIS (TSA), A NDE METHOD, TO MONITOR THE STRENGTH OF WELDED JOINTS IN MOTORSPORT CHASSIS.

FIG.5 DYNAMIC TENSILE TESTING MACHINE

RESULTS

A stress amplitude of 20% or more is crucial for inducing significant stress, but challenges persist under diverse loading conditions.

Extended testing on samples with different weld qualities demonstrated TSA's effectiveness in identifying structural faults. However, a cautious approach is essential in real-world applications, considering factors like loading conditions and sample selection.

Looking ahead, refining methodologies and addressing challenges will enhance TSA's precision, paving the way for advancements in non-destructive evaluation techniques for welded structures.
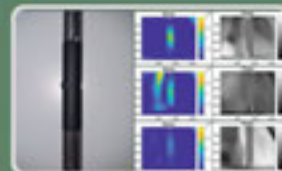
FIG.6 POOR WELD STRESS MAP
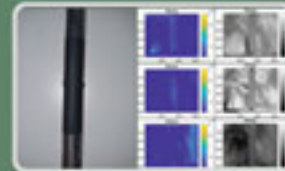
FIG.7 GOOD WELD STRESS MAP

Comparing Methods of Measuring Battery State of Health

The Project

Accurately measuring the state of health (SoH) of a rechargeable battery over time results in better predictions of battery lifespan and therefore less unnecessary battery replacements. The Waikato Battery Research Group recently developed the equivalent circuit model (ECM) and U-factor methods to measuring SoH. This project compared the two methods with the standard Coulomb count method to identify the most promising method.

Method

The **Coulomb count** method measures the overall charge capacity of the battery (0%-100%) to measure SoH.

The **equivalent circuit model** method measures the degradation of each component within the circuit to measure SoH.

The **U-factor** method estimates the efficiency of the charge and discharge of a battery to measure SoH.

The same set of raw measurements (Figure 1) were used to calculate SoH using all three methods. This data was then compared with each other to determine if the new methods are consistent with the standard method, and which method has the clearest trend in predicted SoH.

Figure 1: Raw Battery Measurements

Which method is best?

Figure 2 is a comparison of all three methods. Both the Coulomb count and ECM methods have a significant amount of noise with extremely weak trends over time. The U-factor has virtually no noise and a subtle but consistent trend.

Figure 3 is the comparison of the U-factor method and the impedance drift of the ECM method. Modifying the ECM to measure the impedance drift rather than other parameters, reduced the amount of noise and created a clearer trendline. At higher frequencies, there was up to 10% change, while at the low frequencies, which are more relevant for capacity, there was a <1% change, consistent with the other methods.

With this modification the ECM method is more consistent than the Coulomb method, and shows that the battery is behaving differently, suggesting a decrease in SoH. However, the U-factor still has significantly less noise with a stronger trendline than the modified ECM method. As you can see from Figure 3, the U-factor method is extremely consistent and is able to detect minute changes, believed to be due to reduction in SoH. Therefore the U-Factor is the most promising method for estimating battery SoH.

Figure 2: Comparison of different methods

Legend:
- Coulomb Count Capacity
- Capacitor value (Circuit Model)
- U Factor

Figure 3: U Factor and Normalised Impedandce

normalised filtered impedance at
- 0.1mhz
- 0.5mhz
- 5mhz
- 20mhz
- 1hz
- restart
- U factor max
- U factor average
- U factor min
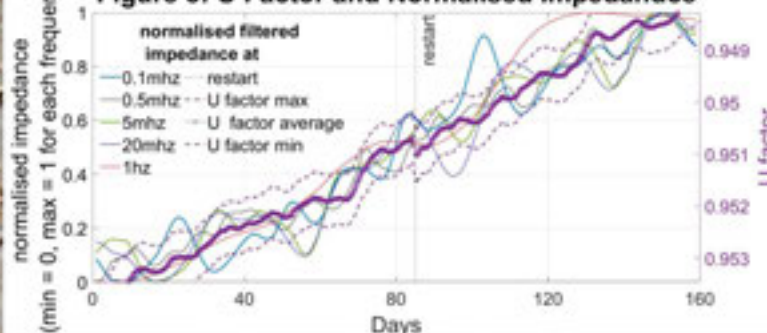
Further research

This project measured the SoH of battery over a short period of time (6 months). As a result there was only a small level of battery degradation. The next step would be to measure battery SoH over a much longer period of time to see significant degradation in battery SoH

Non-Destructive Testing Of Porous Materials

By: Loghan Saravana Ganesh
Supervisors: Dr Chanelle Gavin
Dr Rachael Tighe

INTRODUCTION

Functionally graded materials (FGMs) are composite materials with varying properties based on their location, thereby introducing difficulties in their manufacturing process. To help overcome the challenges of FGMs, they will initially be manufactured in the form of polymer foams. **Digital image correlation (DIC)** will be used to non-destructively test the replicated FGMs. DIC is an optical method that uses paint speckling and compares the changes in a sample before and after being tested. DIC helps in identifying regions of interest in the FGM sample by analysing different regions of deformation and by strain measurements. Our project aims to enhance the properties of FGMs through development and validation of a novel data collection method.
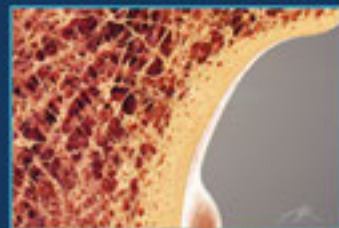
Cross-section of a human bone (example of an FGM)

PROJECT AIMS AND OBJECTIVES

- Promote sustainability in material use
- Expand the applications of FGMs demonstrating their superior properties, as compared to non-FGMs
- Identify the best method for producing the ideal speckle pattern to help in testing the strain rate and tensile and compressive properties using DIC

METHODOLOGY

- The FGM samples will be 3D printed in the shape of a dog bone for tensile testing and a cuboid shape for compression testing.
- The printed samples will be coated with white paint using a spray can. They will be speckled with black paint by a spray can or an airbrush.
- Testing will be conducted on a universal testing machine for calculating compression and/or tension.
- The experimental response of samples under load will be measured using digital image correlation (DIC) equipment.
- Based on the results, a comparison will be made between the well-defined materials and the FGMs.

Methodology (contd.)

1. 3D PRINTING - Samples for tensile and compression testing printed with Creator Pro Flashforge 3D printer using black Polylactic acid (PLA).

2. SPECKLING - The surface of the sample is coated with white paint using a spray can and then speckled with black paint either using the spray can or airbrush (A,B).

A. Speckling with Spray can   B. Speckling with Airbrush

3. DIGITAL IMAGE CORRELATION (DIC) - The tensile and compression samples are tested using the Instron 5982 100kN tensile tester. The DIC equipment is set up to measure the deformation or displacement of the samples which are subjected to the loading.

DIC Equipment setup

RESULTS
Data shown for a default solid sample

1. Tensile sample after testing

2. Images depicting strain at different times during the tensile test of a solid sample.

1. Start of test before load was applied

2. More than halfway through test where strain is visible (depicted by varying colours)
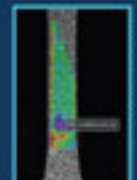
3. Just before sample was about to break (shown by dark area)
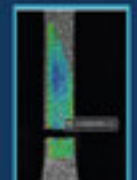
4. Sample broken

CONCLUSION
Further testing to be done in the future

Compression samples with set infill densities (100%, 75%, 50%, 25%, 15%) and gradient infill densities (100% at the ends with 50% in the middle for example)

Tensile samples with a honeycomb section (pictured) to replicate FGMs. Other designs such as squares, diamonds, triangles, etc. to be considered

DESIGN A BRIDGE FOR SCHOOL OUTREACH

BACKROUND

As part of my placement at the University of Waikato Summer Research Programme, I have been assigned the development of a mobile and dismantlable bridge. With aims to expand educational outreach, this project is intended to inspire the next generation of engineers by introducing them to practical aspects of the discipline through hands-on experience.

METHODOLOGY

The project encompasses a range of tasks including the identification of the bridge's limitations in terms of transportability and adherence to budget constraints, an in-depth review of existing bridges that are currently being utilized in educational activities, the development and planning of engaging activities specifically tailored for school children, the detailed design of the bridge along with its individual components, and the innovative application of Virtual Reality (VR) and Augmented Reality (AR) technologies to enhance the educational experience.

PROBLEM

The project addresses the need for interactive educational methods in engineering for school children and leavers, inspired by successful bridge-based learning projects in Auckland and the UK. It aims to blend classroom theory with practical activities like designing, constructing, and testing model bridges. This approach emphasizes practical learning's importance, fostering teamwork, problem-solving, and creative thinking, and inspires future engineers by demonstrating engineering principles in real-world applications.

AIM

The primary aim of this project is to design and construct a portable, easily dismantlable bridge, about 12 meters long, for easy transportation to schools in the Hamilton and Tauranga regions. This bridge is not only a learning model but also a hands-on educational tool for teaching students about bridge design, construction processes, and the importance of sustainable engineering practices. It's intended to engage students practically, enhancing their understanding of civil and structural engineering complexities.

CONCLUSION

The bridge design is complete and it is now in the manufacturing phase. This progress was supported by the sponsorship of Fletchers and Ice. The 3D design of the bridge has been adapted for a virtual reality headset, allowing users to move and view different parts of the bridge in a detailed and interactive manner.

Poster created by Lucus Mactier
Supervisor by James Lim & Ray Hudd

Green Roof Implementation in Tauranga

Matthew Boettcher

Krishanu Roy (Supervisor), Arthur Fang (Co-Supervisor), Stéphanie Keller-Busque (Tauranga City Council)

Background

- Tauranga City Council has Nature and Biodiversity Action and Investment Plan
- Two main goals of plan are thriving nature and biodiversity at the heart of communities and the built environment supporting the wellbeing of the natural environment.

Project Aim

- Investigating the suitability of Green Roofs in Tauranga and making guidelines around their implementation
- Analysing the environmental impacts of Green Roofs and how this can help Tauranga City Council's goals

Methods

- Internet Research and contact with GREENROOFS NZ
- Conducting a cost-benefit analysis for a Green Roof
- Conducting Life Cycle Assessments (LCAs) for Green Roofs showing environmental impacts over their entire lifecycle.

Conclusion

- Life Cycle Assessment (LCA) done for Greerton Library- carbon output (kgCO2) with Green Roof around ¼ of the carbon output than without one, water harvesting system used with a green roof can supply all needed water for building so there are no water costs
- Price for extensive Green Roof- $250+ per m2, 10% of price for maintenance
- Green Roofs are better suited towards lower buildings with larger roof areas
- Extensive Green Roofs have shallow substrate with smaller plants and intensive Green Roofs have deeper substrate with bigger plants
- Extensive Green Roofs are easier to implement because they are cheaper and weigh much less so less structural reinforcement is needed.

Without Green Roof
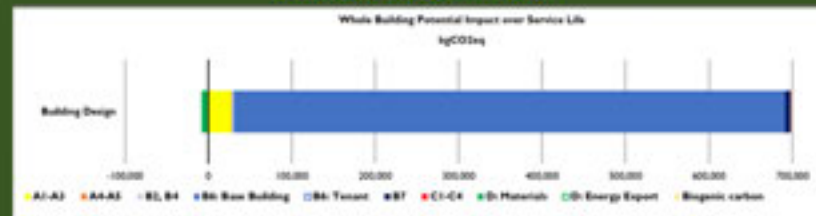
With Green Roof
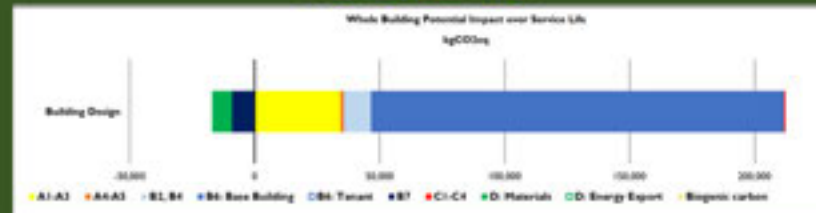
Operational energy carbon output (dark blue) shown above without green roof and with green roof

Modification of Harakeke Fibres for Cosmetic Applications

AUTHORS

Presented by: Nathan Dinan
Supervised by: Christian Gauss and Kim Pickering
Acknowledgements to: The University of Waikato Summer Research Scholarship Programme

04. Processing

The optimal method for processing Muka is as follows:

Hammering and Knotting → *Brushing* → *Treating*

Dry Brushing ← *Waterproofing* ← *Dry Brushing*

Manual Brushing

The brushing machine was constructed to optimise the processing efficiency of Muka, as it is the only aspect of the process that could be improved.

Automated Brushing

05. Treatments

Three treatment conditions were explored: bleaching, soda ash, and retting. The bleaching and soda ash treatments are alkaline-based, while the retting treatment utilises water and natural enzymes over a long period of time.

Bleaching   *Soda Ash*   *Retting*

01. Background

Harakeke is a significant plant in New Zealand, with common flax and mountain flax as its main types with variations within. This plant is used in products like soaps, hand creams, and shampoos. Harakeke fibres, called Muka, are composed of cellulose, hemicellulose, pectin, lignin, and waxes, while cellulose provides stiffness. Muka can be seen as a composite within a composite.

02. Problem and Aim

The cosmetics industry wants to be more sustainable by using fewer petroleum-based materials and synthetic or animal fibres. They are looking into using Harakeke fibres for cosmetics because they have unique properties. The goal is to create Harakeke fibres that are thin (70µm to 80µm), long (>60mm), soft, and resistant to fibrillation (when the fibres start to come apart).

03. Muka Characterisation

The optical stereoscope was used to measure the fibre diameter along the length of the leaf. The bottom and top halves of the leaf are shown for reference.

Bottom Half of Leaf   *Top Half of Leaf*
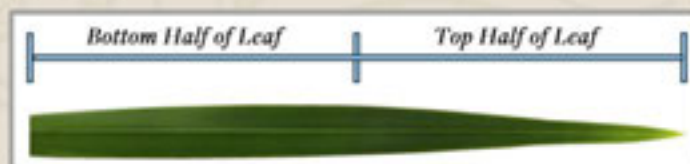
Both old and new Muka leaves show a trend where the fibre diameter slightly decreases from the bottom half to the top half along the length of the leaf.

Muka Diameter Characterisation of New Leaf

Muka Diameter Characterisation of Old Leaf
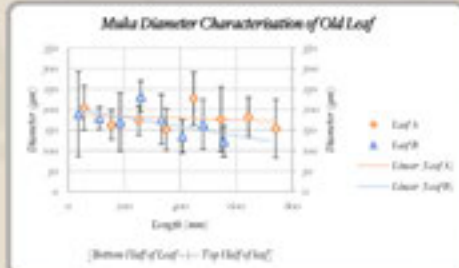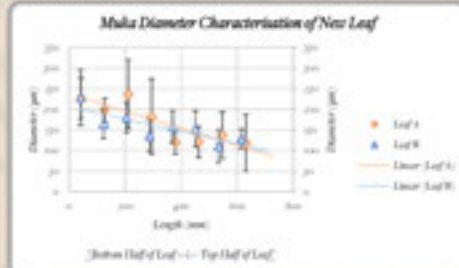
New Muka leaves generally have slightly smaller average fibre diameters compared to older Muka leaves. However, both types of leaves have significant variations in fibre diameter along the length of the leaf.

6-9 Month's Old Muka			
Top Half Average Diameter	130.48	±	45.99	[µm]
Bottom Half Average Diameter	194.14	±	62.60	[µm]
Average Muka Diameter	**162.31**	±	61.34	[µm]

Muka as viewed under the optical stereoscope.

2-3 Year's Old Muka			
Top Half Average Diameter	167.13	±	65.12	[µm]
Bottom Half Average Diameter	182.74	±	61.98	[µm]
Average Muka Diameter	**174.93**	±	29.06	[µm]
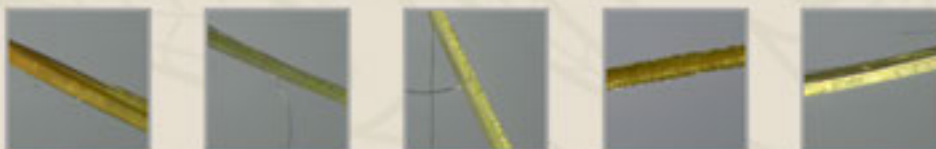
06. Waterproofing

Natural fibres, such as Harakeke fibres, have a tendency to absorb moisture, which can lead to issues like mould growth and stiffness. To address this, hydrophobic coatings are often applied to natural fibres to make them more water-resistant. In this case, a silicone micro emulsion was used as a treatment to make the fibres soft to the touch and water-resistant.

Bleached   *Soda Ash*   *Retted*

07. Stiffness Testing

The stiffness of Muka fibres was tested using dynamic mechanical analysis (DMA). Each sample was encased with tape to hold together and standardised by weight. Untreated Harakeke served as the baseline for stiffness, while lyocell, a soft synthetic fibre made from wood pulp and commonly used in textiles, served as a low stiffness reference. The softest fibres were obtained through the bleaching treatment, followed by the soda ash and retting treatments.

Stiffness Comparison
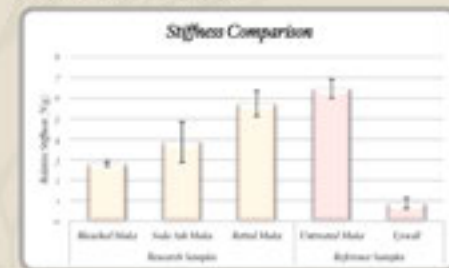
08. Conclusion

In conclusion, Muka leaves have a slightly smaller diameter at the top compared to the bottom, and younger Muka leaves tend to have slightly smaller diameters than older ones. The brushing machine improves processing efficiency, and the bleaching treatment results in the softest Muka.

Related literature

Basu, G., Mishra, L., Jose, S., & Samanta, A. (2015). Accelerated retting cum softening of coconut fibre. Industrial Crops and Products, 77, 66–73 https://doi.org/10.1016/j.indcrop.2015.04.012

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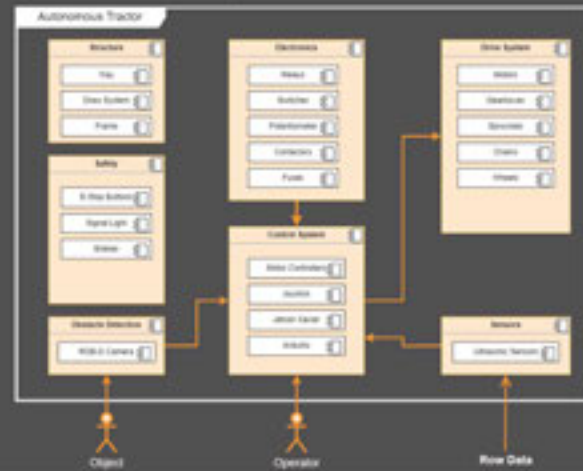
Human-Assist Strawberry Harvesting

Ryan Adams
Supervisor: Nick Pickering

PROBLEM

The strawberry farming industry has been facing ongoing challenges, primarily driven by labour shortages and a lack of cost-effective, modern technology. This technology gap has led to issues with efficiency, productivity, safety, fruit damage, and ergonomic practices. Therefore, there is a clear need to update and improve operations to address these challenges and improve overall performance and sustainability.

DEVELOPMENT

The concept for this autonomous tractor unit was done using CAD. This concept was then manufactured, assembled, and tested using various components set out in the UML diagram below. The control system uses an Arduino to receive distance measurements from the ultrasonic sensors via UART, which are then sent over serial to the onboard jetson. This data controls the steering when in autonomous mode, where a speed adjustment knob is used to set various picking speeds throughout the season. the safety features of the system include an RGB-D camera for obstacle detection, an emergency stop circuit to cut power to the motors, a signal light indicator, and braked motors. The jetson communicates to the motor controllers using usb-to-RS232, and the overall control system communicates through the use of ROS2 (Robot Operating System).

AIM

The aim of this project was to research and develop a low-cost autonomous tractor unit to replace the existing tractor at Strawberry Fields, Matangi, so that safety, efficiency, fruit health, and productivity are optimised. This tractor unit needed to pull a series of ergonomic buggies behind it to assist the pickers.

CONCLUSION

The cost-effective navigation system proved to be highly accurate and generated an excellent result. Field trials are scheduled for 31/01/24 - 02/01/24, where official test results will be available after these dates. These results will support the outlining aim of this project.

Battery Life

1.75Ah per Buggy Unit

- Obstacle Detection
- Safety Features
- Adjustable Width
- 4WD
- Level 3 Autonomy
- Low Cost

Sensor Data

Right Sensors (mm)

Left Sensors (mm)

- Signal Indicator
- RGB-D Camera
- Control System
- E-Stop
- Draw System
- Drive System
- Ultrasonic Sensors
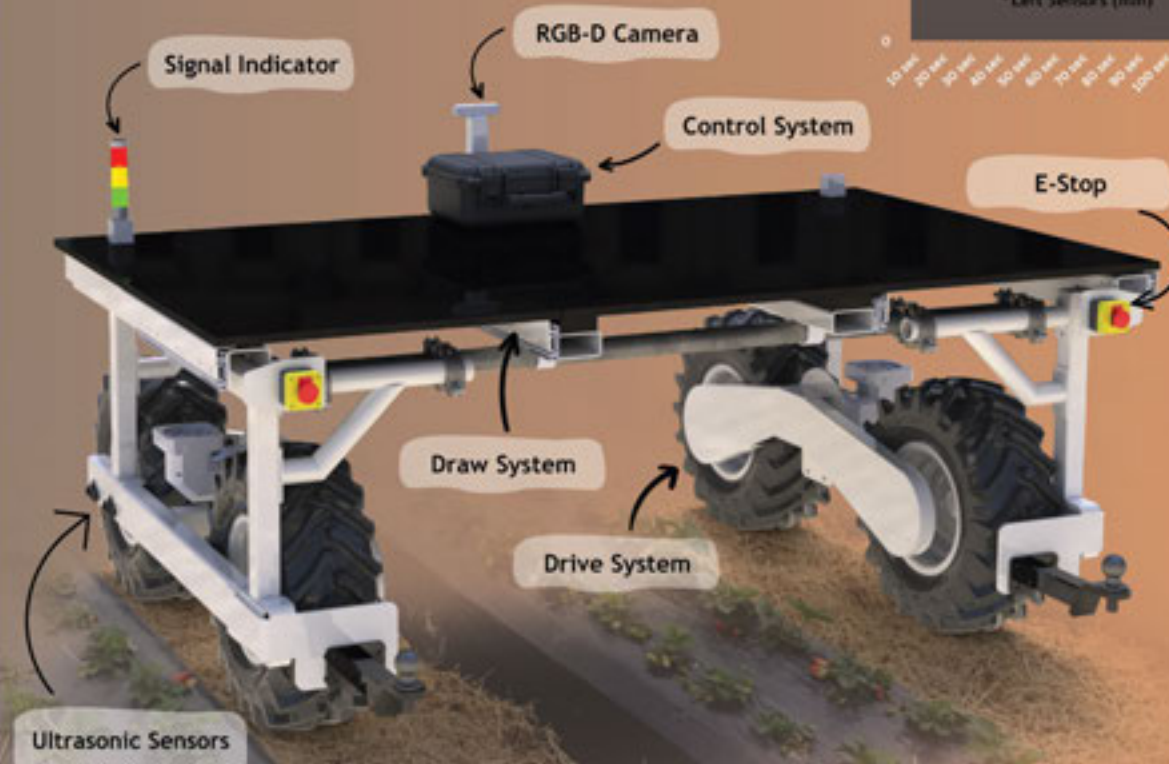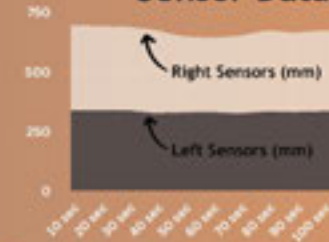
Biodegradable Foam from Recycled Paper: An Alternative to Polystyrene Foam

Seham Alnaser
Supervisors: Dr Dalour Beg & Professor Kim Pickering

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Introduction

- The traditional foam materials that are used for protection are produced from petroleum-based plastic foams such as expanded polystyrene and polyethylene.
- These foams are non-biodegradable and often end up in landfills, leading to significant environmental issues due to the release of harmful gases and leachate.
- Therefore, the development of cellulose-based packaging foam can contribute to minimising the pressure on the landfill.

Aim

- Production of sustainable lightweight cellulose-based packaging foam from recycled paper.
- Investigate optimizing foams through control of formulation based on the amount (wt.%) of fibre, additives, and the number of processing cycles of pulp fibre.

The process of production

Figure 1: flow chart of the production of cellulose foam material

Results

Figure 2 : Comparison of the appearance of cellulose foam a) unprocessed and b) cellulose foam processed with super masscolloider at 3×150 μm & 3×100 μm and c) cellulose foam processed at 5×100 μm & 5×50 μm & 5×10 μm.
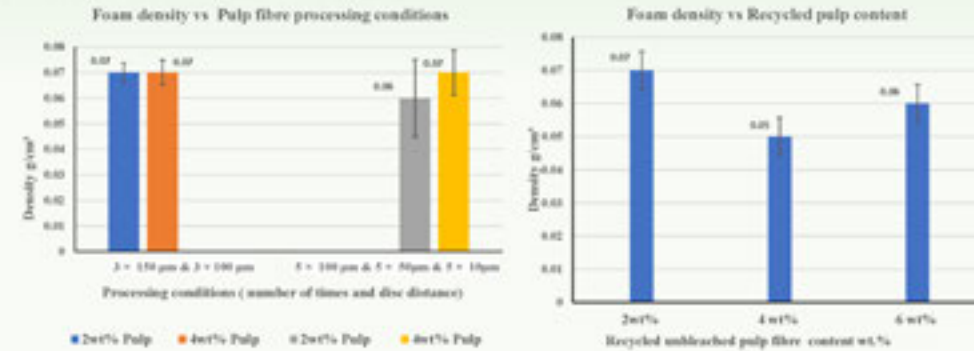
- Processing of pulp fibre with the super masscolloider can induce fibrillation of the cellulose fibres, leading to a stable and uniform foam structure.
- The more refined pulp fibre resulted in a more uniform foam structure and less density.
- The density of foam can be affected by the percentage of recycled pulp fibre used in its production.
- The more refined pulp fibre resulted in a more water-stable foam structure.

Conclusions

- Refining the cellulose pulp fibres can improve the properties of the foam by creating a more consistent and less dense structure foam.
- The optimum formulation was based on the low density, water stability and cohesive structure of the foam.
- For the virgin bleached pulp, the optimum formulation was 2.0 wt. % fibre/water suspension, and 0.08 wt.% SDS (based on the suspension weight).
- For the recycled unbleached pulp, the optimum formulation was 2.0 wt. % fibre/water suspension, 0.05 wt.% PLA, and 0.05 wt.% SDS (based on the suspension weight).
- **Recommendation:** Further investigation is required to improve the mechanical, and thermal properties of the optimum foam formulation.
- **Acknowledgments:** Thanks to Dr Dalour Beg, Professor Kim Pickering, and Dr Christian Gauss for their support.

Lab on LEGO

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Te Whare Wānanga o Waikato

student name: Yixaun Liu; **supervisor name**: Dr Peter Kovalsky

BACKGROUND

In the experiment, we conducted two experiments: one was to study the capacitive deionisation technique, and the other was a centrifugal microfluidic experiment.

Capacitive deionisation is an evolving technology that removes ions from bulk liquids. There are ongoing investigations and studies into capacitive deionisation technology's use and technical limitations. One particular investigation is the use and performance of capacitive deionisation technology in whey desalination (Tapper & Kovalsky, n.d.), where fouling in the device was observed to reduce performance.

Laboratory on Disk (LoD) can integrate separation, mixing, reaction and detection of nano-sized molecules in a single platform. Over the past time, centrifugal microfluidics has undergone tremendous development.

AIM

To understand what is happening within capacitive deionisation technology and examine the pH distribution.

The reaction of NaOH with aluminium metal and diluting HCl to produce hydrogen was realised by 3D printing a resin tabletop in combination with Lego microfluidic channels.

METHODOLOGY

Collect data from past studies and integrate them; Capacitive deion technology, centrifugal microchannel technology and Lego platform are combined

Modeling is done in Solidwork, and then VisualCAM is used to handle the modeling. The model is then machined using an SRM-20 desktop machining machine.

Assembly of the processed components, collection of data and video analysis of the experiment.

The data collected will be analysed, compared with previous experiments and the design will be improved based on the data obtained.

RESULTS
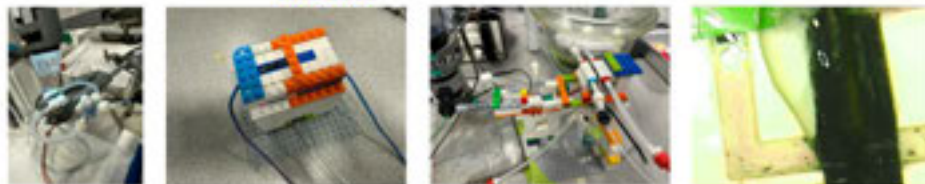
CAPACITIVE DE-IONIZATION

By continuously upgrading the Lego microfluidic channel and the MMCDI, we obtained the same results as in the COMSOL simulation, and we were able to observe experimentally the change of the solution pH value inside the capacitive deionisation device.

PRECISION REACTOR
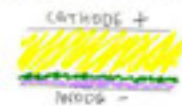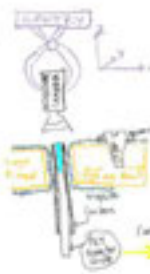
Standard membrane-less CDI stack encasing a 5000 x 5000 x 250um microreactor. The stack is compressed by the addition of left force on the lego-on-rail imparted by an M4 grub screw. A small volume of pH8 PO4 solution with 50%dye was added, and the CDI was driven to 2V;

A fuzzy purple hue was observed to coat the anode after about 30 seconds of charge. It continued to darken the longer the charge cycle went on. When the polarity was switched, the fuzzy hue immediately disappeared. This phenomenon was observed on either carbon plate.

After the picture on the right we can observe that two different coloured solutions are mixed in the microfluidic channel and flow into the cistern on the right, producing a clear change in colour; proving the feasibility of the device, and that the reaction of NaOH with Aluminium metal and dilute HCl produces hydrogen.
The reaction of NaOH with Aluminium metal and dilute HCl to produce hydrogen was carried out.

CENTRIFUGAL MICRO-FLUIDIC LEGODISK

CONCLUSION

After a large number of experiments and data collection, it has been proved that many experimental projects can be completed through the processing of LEGO, and a large amount of money can be saved; however, due to the experiments are not perfect, although the experiments can be carried out smoothly, and with the software simulation of the same conclusions, but a lot of details still need to be improved, such as in the MMCDI experiments in the internal part of the device can not be perfectly processed, and there are also In the centrifugal force experiment, the 3D-printed desk could not be of the same quality, resulting in vibration during operation; however, we can conclude that the idea of Lab on LEGO instead of expensive experimental equipment is a feasible one.

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UNIVERSITY OF WAIKATO SUMMER RESEARCH PROGRAMME

SCAN ME

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Te Kura Rorohiko Me Ngā Pūtaiao Pāngarau – School of Computing & Mathematical Sciences

Bending the Rules
Self-adapting rules for smart home devices

Poster by Allyana Porteria, supervised by Associate Professor Judy Bowen

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Background

Smart home automation requires different tools and services to make users' lives easier [1]. However, tech-savvy and rookie users alike are inconvenienced by one notable flaw of SH automation, requiring the user to make changes to their devices' app settings or scripts to fit their ever-changing daily routines [2].

Question

How can rules for smart home devices be changed automatically without the need for users to write and refine their own scripts?

WHEN the *time* is 9:00pm, THEN turn on *lounge lights*

WHEN the *time* is ~~9:00pm~~ 8:00pm, THEN turn on *lounge lights*, BUT ONLY IF today is not a Friday

Method

1. Identify what components are needed to create a structured rule
2. Assess how a change in a smart home resident's routine may affect a rule
3. Assess how this rule may adapt to the new routine
4. Create an algorithm to demonstrate how this can be done

Key Findings

- A "when, then, but only if" *(trigger-filter-action)* model is used, inspired by openHAB.

- A series of interaction scenarios using example rules were made with Node-RED [Figures 1a, 1b, 1c].

- A text file of rules is parsed in [Figure 2]. User "actions" using Node-RED buttons [Figure 3a] are read in as triggers and/or action cancellations. [Figures 3b]

- The amount of times each action is cancelled (reversed or changed) is recorded [Figure 4a].

- The rule is changed if an action has been cancelled enough for there to be a pattern (e.g. rule is cancelled only on Mondays). [Figure 4b]

- The user is given 10 minutes before actions are no longer "cancelling" [Figures 5a, 5b].

Outcomes and Discussion

This algorithm was able to identify changes made to a rule followed by a set of SH devices and adapt to them, without programmatically changing a user-defined script.

Next steps:

- Investigate the impact rules acting on/triggered by the same devices have on each other when there is an overlap in execution time
- Identify how adaptation may occur in rules where the order of execution of actions is important
- Implement the same concept for device-to-device interactions
- Find the optimal duration for an action's cancellation timer

Figure 3a: Node-RED acting as a remote via MQTT broker

Figure 1a: Rule execution simulation using Node-RED - "WHEN power of garage_lights is set to on, THEN shut garage_door"

Figure 1b: Message payload of left node cluster representing garage_lights

Figure 1c: garage_door (right node cluster) receives garage_lights status information, then decides if action is performed based on message

Figure 2: Parsing rules from text list

```
** User action: set power of lounge_lights to on **
power lounge_lights on
Device: lounge_lights
Device property : power
Action will set power to: on
```

Figure 3b: Information via MQTT/Node-RED

```
Times run: 3
Times cancelled: 3
Count of rules before deleting: 3
Amount of actions in rule: 1
Only one action in rule. Deleting rule...
Count of rules after deleting: 2
```

Figure 4b: Removal of an entire rule with one action (user always reverses action in this case)

```
Cancel instance is created.
Date of cancellation: 2024-01-28
Time of cancellation: 19:14:23
Day of cancellation: SUNDAY
Action is cancelled.
```

Figure 4c: Cancellation instance is created, logged in real time

```
All filter conditions are met
Passed property: tone
Passed state: warm
Rule action: setting tone to warm
Timer running ! Mins passed: 1

Timer has timed out and can no longer be cancelled
```

Figures 5a, 5b: Timer for an action to consider a cancellation

References

[1] Ur, Blase et al. (2016). Trigger-Action Programming in the Wild: An Analysis of 20,000 IFTTT Recipes
[2] Yu, H., Hua, J., & Julien, C. (2021). Dataset: Analysis of IFTTT Recipes to Study How Humans Use Internet-of-Things (IoT) Devices

Cybersecurity Down Under: Comparing Internet Security Practices in New Zealand and Australia through examining TLS Configurations

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Andrew Lin, Kevin Han, Bruce Parkinson, Marinho Barcellos
School of Computing and Mathematical Sciences

1. Introduction/Background

Internet security is crucial in today's digital age, and **HTTPS** (Hypertext Transfer Protocol Secure), which uses the **TLS** (Transport Layer Security) protocol, has emerged as a key protocol used on the Internet to secure communication using end-to-end encryption. TLS builds upon the now-obsolete **SSL** (Secure Sockets Layer) and has multiple versions. It offers many configuration choices and is known to be hard to configure correctly.

We hypothesise that networks with **poor security posture** often have weak SSL/TLS configurations. Internet scanning and TLS enumeration can be used to determine configurations, but this process is costly and likely not scalable to the whole Internet. We looked at both IANA standard and non-standard port allocation (i.e. 80 is HTTP and 443 is TLS/HTTPS).

This project involves investigating/comparing the security postures of networks in **Australia** and **New Zealand** based on the SSL/TLS configuration choices across all accessible machines on the Internet (in both countries). This work is **novel** and has **practical implications** for the Internet economies of the two countries.

2. Methodology

Our research does not collect personal info, and it was approved by the University Research Ethics Committee. The measurement and analysis was based on the following steps:

1. Obtaining the relevant endpoints in NZ and AU: The list of HTTPS endpoints to be checked was obtained by sending queries to Censys (an Internet Intelligence Platform) using research accounts.

2. Sanitisation I: The list of endpoints was then checked/filtered for inconsistencies (e.g by filtering out non-HTTPS endpoints).

3. TLS enumeration: An open-source tool was then used to enumerate the TLS configuration options for each endpoint individually. An example of the protocol used for the enumeration of endpoints is illustrated on the right. Measurements were run from 1 host in NZ and 5 hosts in AU for 20 consecutive weeks.

4. Sanitisation II: The SSL/TLS data was checked to eliminate faulty measurements. The final cleaned data contained information collected from around 21 million endpoints.

5. Enrichment/encoding: The data was then parsed into a more efficient data representation, and complemented with information from other datasets (such as geolocation).

6. Analysis: The data was then analysed using statistical tools/techniques (with tools written in Python and libraries such as Pandas). This uncovered trends/patterns which could then be visualised.

Diagram showing the exchange of packets to scan (enumerate TLS options) a single endpoint (IP : port combination)
This process is repeated for all endpoints in AU/NZ:

3. Results/Findings

Looking at the figures above, we can see that both AU and NZ show a decline relative to the midpoint/reference.
However, the roll-offs/gradients are not exactly the same (E.g AU is is less smooth). There is ongoing work to investigate further, such as looking at the role of cloud providers.

The figures above show the Pearson correlation values among the versions for AU and NZ endpoints. The scale ranges from -1 to 1, with positive numbers indicating a positive correlation, and vice versa.

Overall, there seems to be reasonable similarity between Australia and New Zealand. As expected, there is a reasonable correlation between SSLv2 and SSLv3, although when looking at TLS, the correlation varies; For example, TLSv1.3 and TLSv1.2 show relatively low correlation. Surprisingly, the only newer version of TLS to show a reasonably sized (negative) correlation with SSLv2/SSLv3 is TLSv1.2. We are investigating potential causes for this behaviour, such as default configurations.
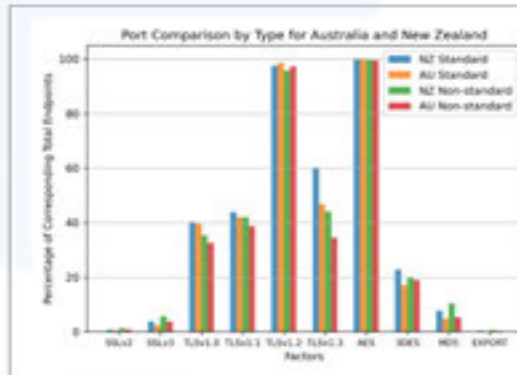
The figure on the left shows the prevalence of different security factors such as protocol versions and ciphers in NZ and AU for both standard and non-standard ports.

We can see that there is reasonable similarity between Australia and New Zealand for both IANA standard and non-standard ports.

We discover an atypical result for TLSv1.3: There are clear differences between NZ and AU in both kinds of ports.

It is good to see that overall, the two versions of SSL (which are insecure) have quite low levels of support. Other potential vulnerabilities/risks such as MD5 hashing and EXPORT ciphers also show similarly low levels of support. However, there is still some (albeit small) support for the 3DES cipher suite, which has been long deprecated.
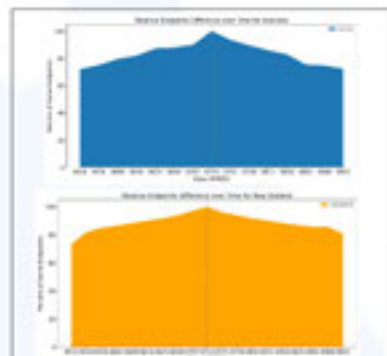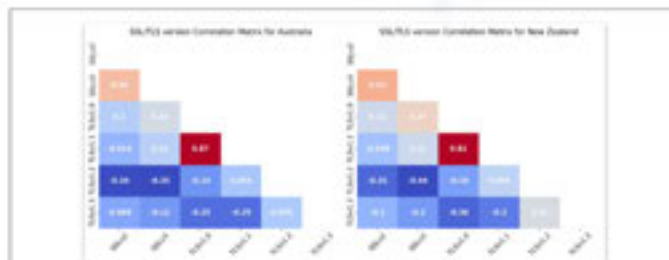
4. Conclusion and Future Work

We discovered interesting (and potentially surprising) similarities in the security postures/ecosystems between Australia and New Zealand, and further investigation is underway to validate/explain the discoveries.

As part of ongoing and potential future work, we are looking at how cloud providers (based in Australia) such as AWS affect the security postures/overall ecosystems. We will also look at different measurements such as digital certificates information, as well as other protocols (such as SSH).

5. Key Bibliography

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- Lee, H., Kim, D., & Kwon, Y. (2021). TLS 1.3 in Practice:How TLS 1.3 Contributes to the Internet. Proceedings of the Web Conference 2021, 70–79.

Ant-Optimised Bus Routes

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TE KURA ROROHIKO ME NGĀ PŪTAIAO PĀNGARAU

Introduction:
Tauranga has some of the worst traffic in Aotearoa[1]. Public transport is an effective solution to many traffic problems[2].

Aim:
The Bay of Plenty Regional Council is proposing a refresh of the bus network in Tauranga. We are implementing an Ant Colony Optimisation (ACO) algorithm[3] to find optimal bus routes. The ACO algorithm is based on how ants work together to find the best path to food.

Method:
The algorithm was programmed in Python, using road and bus stop data from OpenStreetMap, and population data from StatsNZ.

Results:
The ants follow similar key points as the council routes, even though they do not consider hubs or areas of interest. However, the ants show slightly different paths to the council routes as they are trying to maximise coverage.

Conclusion:
With some optimisations and more data, future research could explore designing a network from scratch, factoring in things like operator costs, emissions, bus lanes, and adding the ability to pass through certain points.

Tauranga CBD to Pāpāmoa route proposed by ants:

Scan the QR code to learn about the algorithm and code!

References:
[1] Quality of Life Survey. (2022). Rangahau te Korou o te Ora / Quality of Life Survey 2022: Topline report. https://www.qualityoflifeproject.govt.nz/wp-content/uploads/2022/10/FINAL-QOL-8-City-Topline-Report_17-October-2022.pdf
[2] New Zealand Transport Agency. (2013). How does public transport benefit New Zealanders. https://www.nzta.govt.nz/assets/resources/public-transport-information-pack/docs/public-transport-information-pack-no-1.pdf
[3] Wei, Y., Jiang, N., Li, Z., Zheng, D., Chen, M., & Zhang, M. (2022). An Improved Ant Colony Algorithm for Urban Bus Network Optimization Based on Existing Bus Routes. ISPRS International Journal of Geo-Information, 11(5). https://doi.org/10.3390/ijgi11050317

What do you want to know about "Kids Questions"?

Try starting your question with: Who ... | Where ... | When ... | What ... | How ... | Why ...

You could ask a question about:

How do children use search engines?

How is search engine use impacted by language?

How do we make it easier for kids to get information?

What was my goal in this project?

aim.kidsquestions.cms.waikato.ac.nz

My aim was to get a functional search engine for kids running in Te Reo Maori so Nic could use the data gathered to perform analyses on the differences in behaviour between children searching in Te Reo Maori and English. This was along-side improving any parts of the code which were deprecated or faulty. After examining the code, replacing the deprecated server and programming language and ensuring authentication became my priority.

How did I attempt this?

method.kidsquestions.cms.waikato.ac.nz

I used an AGILE form of production, repeatedly switching between designing, developing and testing my code before I moved onto the next component, and logging progress consistently. Using a requirements analysis, I determined what wasn't up to the specifications I was given. I focused on the frontend first, replacing the code and ensuring I got the same results as the original, then I added more features to both the frontend and backend database and API webapp.

What did I end up with?

results.kidsquestions.cms.waikato.ac.nz

The project is not wholely completed yet, but the English search has been improved and we have a fully functioning Te Reo Maori search page which will send children to the appropriate page depending on the details of their account when it is set up. The language they work in can be swapped by the admin users to get control and test data for Nic's analyses.

How will we continue this research?

conclusion-and-future-research.kidsquestions.cms.waikato.ac.nz

The search engine is not completely finished as I still want to implement the ability for users to view their search history, links they have remembered and marked for later and get related topics to their search behaviour. I also need to implement ways to make it easier to display and edit data on the admin end.

Kids **Questions**

What is KidsQuestions?

background-to-kidsquestions.kidsquestions.cms.waikato.ac.nz

Nic Vanderschantz is researching the interaction between school-aged children and multi-lingual search engines to enhance their interfces to better support the tamariki of Aotearoa.

Kids' Questions is the software being used to conduct and gather data for this research and acts as our own modifiable search engine. I was tasked with the job of maintaining and upgrading the software to keep up with technological advancements, and increase the range of functionality of the site so that Nic can expand his research.

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**Research conducted by D. Greaves
Supervised by N. Vanderschantz.**

Introduction

This project aims to provide a visualisation tool for incoming network traffic on dedicated servers including honeypots. The tool displays countries originating most traffic in addition to showing cumulative network traffic generated each hour of the day.

Data Flow Architecture

The visualising tool's architecture consists of following six steps, presented in figure 1 as well.

1. A user uploads a log file using the frontend interface, React.js.
2. The file is moved to a dedicated location by Node.js server.
3. FileBeat reads, filters the logs and forwards them to ElasticSearch.
4. ElasticSearch indexes the logs while enriching the data with geospatial information using its GEO-IP processor.
5. Node.js retrieves the geospatial data using ElasticSearch query.
6. React.js receives the data and visualises it on the map and charts.

Figure 1. High Level Architecture.

Result & Conclusion

The architecture accomplished the following key outcomes:

- Effectively visualised incoming network traffic from multiple locations.
- Detailed statistics of the top five traffic origins seen in figure 2.
- Tracking network traffic on hourly basis, providing a clear insight into traffic trends depicted in figure 3.

Moreover, the presented QR code is linked to display a video of the visualiser in action.
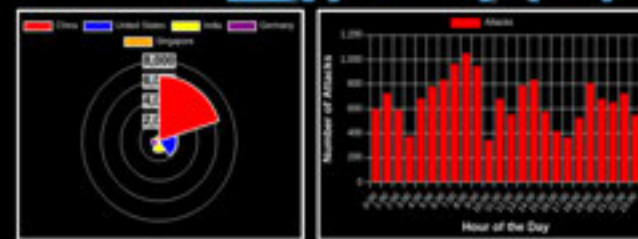
VIDEO QR LINK

Figure 2. Top Traffic Sources

Figure 3 Hourly Network Traffic

In conclusion, the visualisation tool offers an effective means for monitoring network traffic, highlighting key trends. It enriches learning for students and security enthusiasts by clarifying network dynamics.

Reference

Chart.js. (n.d.). *Polar Area Chart*. Retrieved from Chart.js: https://www.chartjs.org/docs/latest/charts/polar.html

D3 by Observable. (n.d.). Retrieved from https://d3js.org/d3-geo

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CYBER ATTACKS FILTERING MAP

Faraz Amjad, Dr. Junaid Haseeb and Dr. Vimal Kumar

Te Kura Rorohiko Me Ngā Pūtaiao Pāngarau, School of Computer and Mathematical Sciences

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CROW

ĀHAU I AM

THE APPLICATION:

Āhau is a Whānau Data Platform that can be used by communities (whānau, hapū, Iwi) to capture, preserve, and share important information and histories into secure, whānau managed databases and servers. The application is free and open source. The decentralized data model means that the users keep control over their data.

THE TECHNOLOGY:

Āhau uses the scuttlebutt protocol for enabling its decentralized data structure and peer-to-peer connection data sharing model. Data such as photos, videos, audio and documents are called artefacts. These artefacts are stored locally.

The artefacts which can be Audio, Photo & Video will take advantage of access protocols. These access protocols will make sure that the artefacts are shared within the tribes and intended Whānau .

Āhau makes use of Vue.js framework. Vue is an flexible framework capable of creating reactive application. The framework can be used to code in such a way that the application is reactive and dynamic. The code of the application is structured in such a way that the various elements and functions application can be reused quite easily.

PROTOCOL: SCUTTLEBUTT

API: GRAPHQL

FRAMEWORK: VUE.js

APPLICATION

SCAN TO CHECK OUT AHAU.IO

Āhau's application infrastructure is unique. The user has unparalleled sovereignty over their data with the ability to seamlessly upload it to an online Whānau database with encryption and special key fortification
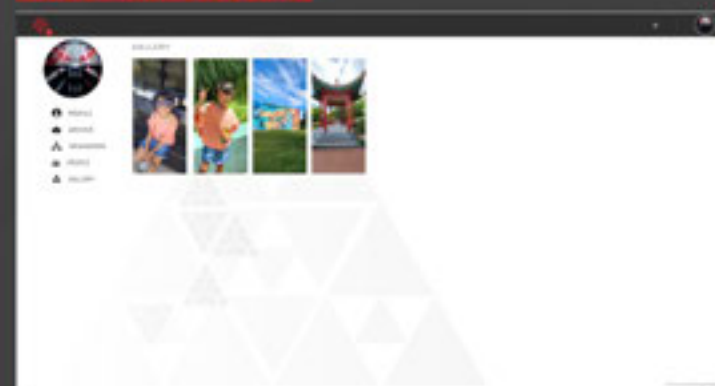
THE OBJECTIVE:

The objective of the project was to create a gallery for the application. The gallery would display all the artefacts that are saved by the user and the connected family.

THE METHODOLOGY:

The logic and process flow for the gallery is as follows:

Gallery component → Query Artefacts → Retrieve & display

The custom UI component artefactGallery.vue was developed and routing was created in the application to the proper component

The component uses GraphQL queries to load the artefacts from the storage. The protocols in place makes sure that the artefacts are visible only to those with permissions.

The gallery displays the artefacts in a grid layout. When you click on an artefact it will preview and display additional details and the option to edit.

THE RESULT:

The result of the gallery integrated into the app is shown on the right. The flexibility of Vue.js streamlines further component integration, promising a dynamic and expandable gallery experience

It's a □ with &

Poster by Joel Crombie
Supervised by David Nichols and David Bainbridge

The Proliferation of Character Encoding Errors in Academic Publications and Its Impact on Discoverability of Research Articles

Introduction

- There has been a rising problem in world of academic articles and works; character encoding going awry.
- Searching for specific authors and works becomes more challenging as names and titles deviate from ASCII characters. Some non ASCII characters are being mistranslated into characters they aren't.
- To solve this issue, it would be best to find out how widespread these issues are (is this confined to one or two publishers?), and what kind of errors are actually present.

Aim

- To develop a software suite to correctly identify erroneous character encoding in academic paper titles online.
- To use this to determine the scope of the problem and be able to classify each error.

Examples

- "Long-chain dicar□ylic acids"
- "Materials for Medical Device R&D"
- "晚渐新世&lt;bold&gt;-&lt;/bold&gt;早中新世气候变化在赤道大西洋的天文响应"

Method

Retrieve Crossref metadata records

Use developed software to ingest metadata into a MongoDB database

Create programs in Python to investigate properties of the dataset

Percentage of Titles with "&amp" from Crossref
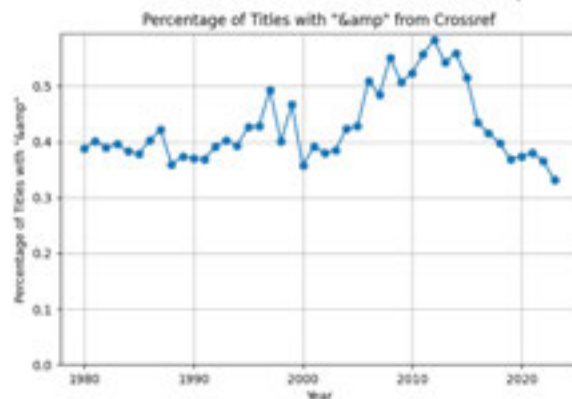
Figure 1: Prevalence of a specific kind of HTML Error over time

(In Future)

Get more datasets and use them in combination to investigate other errors, and establish the true scope of the errors

Discussion

- Metadata was taken from Crossref's 2023 April metadata download, and all 185.88GB of metadata has been successfully ingested into a MongoDB database.
- This database contains trimmed metadata on 126,544,252 unique works that are all journal articles, proceedings articles, and book chapters.
- Two distinct kinds of errors we observed are HTML entity errors (see Figure 1) and wrong character errors (e.g. '□' in Examples).
- The "wrong character" error may be able to be split into more error taxonomies, however more investigation would need to be done.

Conclusion

- As of the date of this posters creation, the suite is not yet complete and only has the capability to ingest data from one source (Crossref).
- Specific error testing conditions still need to be constructed. This will continue to be worked on into the future, as well as made open source and available online.
- Research could carry on by extending the software suite and developing reliable heuristics to test for bad character encodings.

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Using wearable IoT based physiological data to identify cognitive workload and cognitive fatigue

Poster by Katie Sullivan, supervised by Jemma König
School of Computing and Mathematical Sciences, University of Waikato

Introduction

During this project, we investigated whether EEG signals can be used to identify cognitive fatigue. Cognitive fatigue occurs after prolonged periods of cognitive activity and can result in reduced productivity and motivation to complete a given task.

What is EEG?

- Electroencephalogram (EEG) is a measure of the electrical activity of the brain.
- Taken by placing electrodes on the scalp.
- Used to gain understanding of different states of consciousness, cognitive processes and neurological abnormalities.

Four frequencies of EEG waves

Beta

Beta activity is the fastest and is seen when in an alert state.

Alpha

Commonly seen in people of any age group, but especially in those over 13 years old while they are relaxing.

Theta

Common in children up to 13 years of age and people of any age while they are asleep.

Delta

Tend to have the highest amplitude but are the slowest. It is mainly found in infants under 1 year-old and during stages 3 and 4 of sleep.

Data collection

EEG data was collected using a MUSE headset which has 5 electrodes and four channels located at positions AF7, AF8, TP9 and TP10 according to the international 10-20 system (right). Data was collected from 6 individuals from the University of Waikato, who were aged between 22 and 34.

MUSE headset

Findings

- We are going to look at whether there is a difference between the relative (or absolute) power of EEG spectra before and after the induction of cognitive fatigue.
- We will also look at using machine learning to classify EEG data as 'Fatigued vs 'Non-fatigued'.

Beta [12-30 Hz]

Alpha [8-12 Hz]

Theta [4-8 Hz]

Delta [1-4 Hz]

Time
1 sec
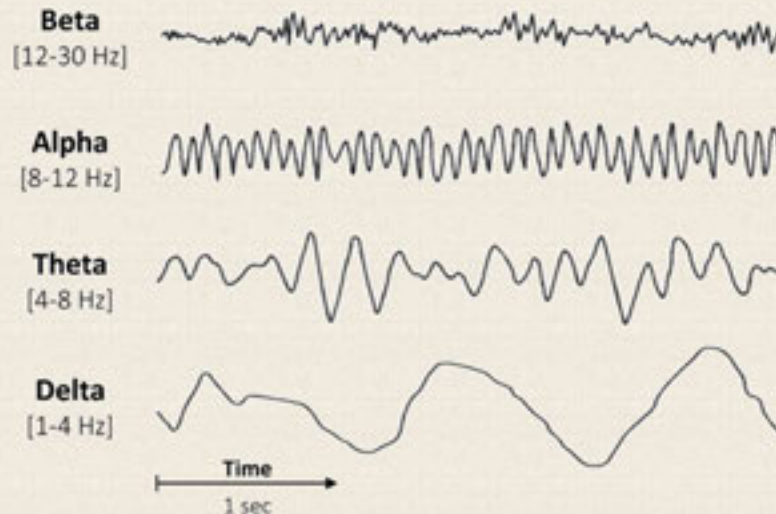
International 10-20 system for electrode placement
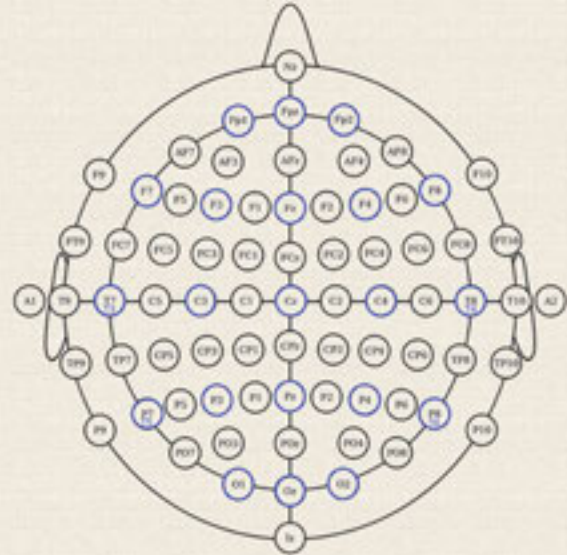
Next steps

- Investigate other types of physiological data such as ECG, EDA and EMG.
- Consider how other physiological data can be used in conjunction with EEG to identify cognitive fatigue.

References

1. Monteiro, T. G., Skourup, C., & Zhang, H. (2019). Using EEG for Mental Fatigue Assessment: A Comprehensive Look into the Current State of the Art. IEEE Transactions on Human-Machine Systems, vol. 49, no. 6, pp. 599-610. doi: 10.1109/THMS.2019.2938156
2. Wang, Y., Huang, Y., Gu, B., Cao, S. & Fang, D. (2023). Identifying mental fatigue of construction workers using EEG and deep learning. Automation in Construction, Volume 151, 2023, pp. 104887. doi: https://doi.org/10.1016/j.autcon.2023.104887
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HOW GAMIFICATION IMPROVES LEARNING

Kingsley Eng, supervised by Shaoqun Wu and Dr Wendy Fox-Turnbull

Introduction

This project aims to design and build a gamified education tool in the form of a mobile game called 'Kete' to facilitate computational thinking in students years 4 – 6. Developed with testing and feedback from teachers and students at Ngāruawāhia Primary School (NPS), it features three progressive difficulty levels inspired by the Māori concept of poutama, that are designed to enhance problem-solving skills

What is Kete

'Kete' is an engaging mobile game where players can either create and play their own maps. Each map is a grid overlaid on a photo chosen by the player, where locations can be added to grid squares. These locations can be customised with labels, images, audio, and text descriptions. Designed for simplicity and intuitiveness, 'Kete' makes learning fun.
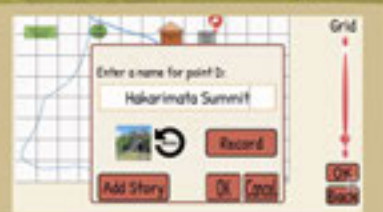
Kete Gameplay

Offering three game modes - FreePlay, TourMode, and SequenceMode - each increasing in difficulty. FreePlay allows for free navigation, TourMode requires visiting locations in alphabetical order, and SequenceMode involves preloading moves and maintaining alphabetical order.

The objective is to navigate successfully to all locations, with a scoring system based on time and button clicks, encouraging efficient problem-solving and strategy.

See it For Yourself

SCAN ME

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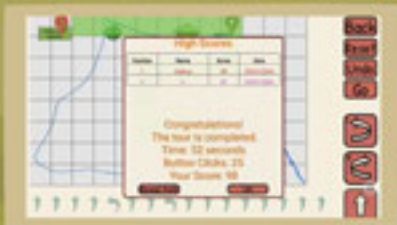
Evaluation

During four visits to NPS with 40 students (10 at a time) years 4 – 6 and two teachers, 'Kete' was tested and refined based on their suggestions and feedback. Highlights include:

1. Kete successfully made learning fun, the students couldn't wait for their turn to play, even though the alternative was playing outside.
2. The teachers noted that kids hated revising their written work, but didn't mind debugging the game. They said this was important as reviewing work was an important part of their curriculum they were trying to teach.
3. The game's immediate applicability in classrooms was affirmed by teachers, who felt confident in using 'Kete' as a teaching tool after just one visit.

'Overall, 'Kete' was well-received as an engaging and effective educational tool by students and teachers alike."

Conclusion

'Kete' demonstrates the effectiveness of gamification in boosting engagement in computational thinking, in line with current digital literacy research. The rapid understanding of our testers validates our user-centric design. Future educational strategies should further explore gamification, emphasising computational skills and regular user feedback and testing.

References

- Majuri, J., Koivistoa, J., & Hamari, J. (2018). Gamification of education and learning.
- Shute, V. J., & Sun, C. (2017). Demystifying computational thinking.

OPERATOR LEARNING ENHANCED NEURAL NETWORKS

OPERATOR LEARNING ENHANCED NEURAL NETWORKS

Thin Nadi San

supervised by

Dr.Jason Kurz

OVERVIEW

Specialized neural networks, called operator networks, are designed to solve multiple instances of a problem instead of a single instance. Two common types are Fourier Neural Operators (FNOs) and Deep Operator Networks (DeepONets), but they are computationally expensive struggle with complex situations. Our Radial Basis Operator Network (RBON) tackles these challenges using a unique approach.

RBON, with its single-layer structure, stands out by using a k-means algorithm to find key points and least squares to determine other parameters. It excels in predicting solutions for various scenarios, especially in four-dimensional situations like anticipating how materials react to laser radiation over time.

HOW NEURAL NETWORK WORKS:
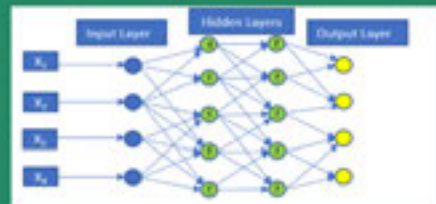
METHODOLOGY

Mathematical functions are employed within the neural network architecture to carry out computations and learn patterns.

In RBON, input X transforms through radial functions and weight parameters, producing output Y at specific locations.

Functions Used → Applying RBON

↓

RBON Operation → Wave Equation in RBON
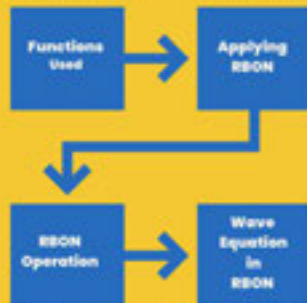
RBON involves spreading and identifying centers in input data, applying radial functions for predictive capabilities in time and speed applications.

RBON mapped wave speed in a spatial-temporal equation, showcasing the model's ability through fixed-and eases resembling mountains.

RESULTS

Experiments	L2 Error	Additional L2 Error
Normal Configuration	9.8291064239996 8e-5	0.0002507754849 5 614727
One Normal, One Lower Configuration	6.6751722101975 91e-5	0.0001644132639 0 30158
One Lower, One Normal Configuration	7.7771363432964 66e-5	0.0001985650864 11 34493
Lower, Lower Configuration	0.0005754814322 1 04649	0.0002796831195 48 3914
One Higher, One Normal Configuration	8.9583450395488 48e-5	0.0002386401084 4 72957

IMPORTANT! The experiments show the wave equations effectiveness in RBON with low L2 errors and accurate dynamic representation across various configurations.

RELATED LITERATURE

Gux, Jason Z and lemon Je and Brenner, R and Glen, C and Zhou, T. A Physics-informed approach to Learning The Operator for Parameter Title. Available at RSRG
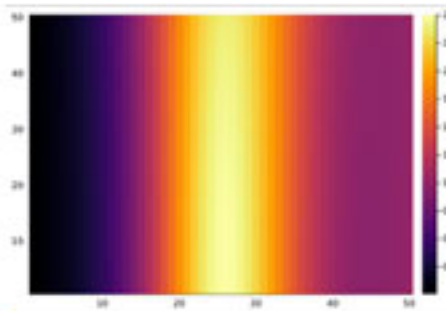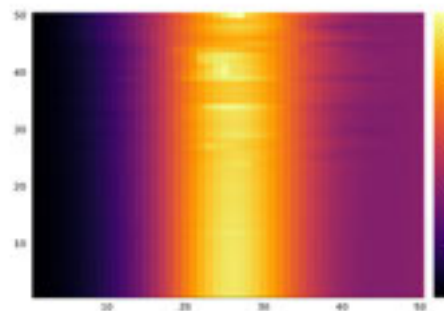
ANALYSIS

True Wave Configuration 1

Predicted Wave Configuration 1

True Wave Configuration 2

Predicted Wave Configuration 2

FUTURE

- **Testing with Burger Equations:**
  - Outline plans to extend experiments to Burger equations and discuss potential implications.
- **Exploration of Other Operators:**
  - Consider future experiments involving different operators and their potential impact on the results.
- **Alignment with Additional Tests:**
  - Discuss the importance of aligning future tests with the identified operators.

Te Raupapa – Waikato Management School

Aotearoa New Zealand Rural Small Firms: Triple Crisis

HARSHMEEN KAUR
DR. JONATHAN SCOTT
DR. ABHISHEK MUKHERJEE

Introduction

- Small enterprises are the foundation of the economy in New Zealand. The "Triple Crisis" of recession, restricted labour market, and COVID-19 shutdown presented numerous challenges for small rural firms.
- Determined the difficulties the "Triple Crisis" has caused for small rural companies.
- We learned about many of the problems rural businesses face and the actions they take to address these problems during our interviews with the businesses.

Research Questions

- What were the significant impacts that your business was facing at that time due to any of the crises?
- How did you address the immediate challenges from any crises at that time to your workforce, customers, and business partners?

Method

Designed Questionaire
Prepared a questionaire to interview businesses.

Literature Review
Studied few published papers to understand the study done in this study.

Interviews Perfomed
Total 40 businesses contacted, 13 interviews finished.

Qualitative Data
Using the Nvivo software for qualitative data analysis, we analysed every interview.

REFERENCES

ABHISHEK MUKHERJEE, JONATHAN M. SCOTT, DAVID DEAKINS, PAUL MCGLADE (2023), "STAY HOME, SAVE SMES"? THE IMPACT OF A UNIQUE STRICT COVID-19 LOCKDOWN ON SMALL BUSINESSES. HTTPS://WWW.EMERALD.COM/INSIGHT/CONTENT/DOI/10.1108/IJEBR-02-2023-0099/FULL/HTML
RNZ (2022, 23RD AUGUST). LABOUR MARKET SHORTAGES AND WAGE PRESSURES TIPPED TO PERSIST. HTTPS://WWW.RNZ.CO.NZ/NEWS/BUSINESS/473307/LABOUR-MARKET-SHORTAGES-AND-WAGE-PRESSURES-TIPPED-TO-PERSIST

Results

- According to the restaurant owner, one of the restaurants is operating at 75% capacity due to the limited labour market.
- People's spending habits have been impacted by living expenses, primarily affecting rural businesses.
- Due to ram raids, businesses had to spend $50,000-$60,000 to increase the security of their premises.

Conclusion

- From the interviews and research conducted, it is evident that many businesses have suffered due to Covid 19, the tight labour market and the recession.
- It also depends on where you live and what kind of business you operate. For instance, the Covid 19 lockdown and ram raids negatively impacted the liquor store, while the Covid 19 restrictions made it difficult for the personnel at the childcare centre to move.
- To mitigate these issues, businesses have to think creatively when hit by crisis.

Product Insights
Gallagher Security

1 Business Challenge / Research Topic

*How can we address **diverse data** needs of business value streams, such as Devices, High Security and Integrations, by identifying useful & consistent datasets that enhance reporting measures in bringing out valuable Product Insights to enable future business benefits?*

2 Objective

The Purpose of this project is to engage with business value streams, challenge existing business notions, achieve quick wins and explore recent advancements to help drive business groups' future forward with insights into product contribution. Objectives include identifying key metrics, re-evaluating **success measures**, understanding and implementing industry and bespoke best practices to help achieve business goals while seeking continuous validation and feedback on the new Product Insights dashboard.

3 Framework, Research Focus and Method

Agility – aligns to Gallagher's Better Ways of Working (BWoW) business transformation plan

Accurate & Consistent Org data – Insights to drive future business benefits and value

Agile Values, Principles and **User Stories** – **open interviews** and active feedback loops

"Users have stories to tell... The data merely plays a supporting role. The great thing about user stories is that they enable... to quickly define the capabilities and features... without investing a huge effort in exhaustive requirement analysis ."

- Ken Collier (Agile Analytics, 2012, p.85, 91)

Research Philosophy aligns with practical approaches Practicality of **Pragmatism** ➡ adaptability to emerging technologies and accommodating iterative problem-solving

No specific hypothesis is outlined, but the project assumes that enhancing reporting measures will contribute to improved business decision-making.

Key Challenge & Solution : Varied expectations from different value groups, solved by **consistent and frequent communications**

Introduction

The purpose of this research poster is to highlight the progress toward new Product Insights reporting, specifically focusing on benefits to Product R&D teams (business value streams) at **Gallagher Security**.

The project aims to enhance reporting of business performance, **standardize** business processes, and address the diverse requirements and management of data of each business value stream. This project provides the base for *Product Financial* decisions, future direction and outcomes.

Listen & Document Reporting Requirements ➡ Assess & Research Industry Practice ➡ Review Data sets & Design Future Reports

Agile BI Framework - **Discover, Design, Develop, Deploy, Deliver Value** (Larson & Chang, 2016)

4 Key findings
: Identification of key metrics. Two clear groups of data requirements have been identified: **Product Performance** and **Product Insights**. User Stories to capture and guide future conversations.

5 Anticipated results
include clarity and expansion on user stories, and the development of two separate **Power BI Report Apps for Product Performance and Product Insights** supporting most business value groups while encouraging stakeholder validation and continuous feedback on delivered outcomes.

6 Feature-driven approach

The key idea and task is to review & re-evaluate status in quo **success measures** and **weave together** industry best practices to bespoke KPIs and deliver incremental value to business value streams via iterations, while simplifying and **inter-twining** **Business Case Financials (target)** and **Actual Sales Performance** for a high-level and holistic set of success measures.

7 My Role & Recommendations

My role in this research project involved **envisioning and formulating strategies** to address diverse data needs of Product R&D teams and improving data visualizations. Another aspect of my work recommends use of Microsoft Power App for data management, incorporating Copilot, while aligning to the company's technology standards.

Project progress includes defining success measures, **proposing new data management and self-serving analytics tools**. Ongoing stakeholder feedback is vital for future success, emphasizing the need for continued collaboration to standardize business processes.

Project quick win : Product *Pricing History* analytics to evaluate market response, categorized by Product and Regional comparison

8 Future Work

- Analyse user stories from all value streams for next stage of solutioning
- Seize **business and tech trends**
- Leverage newer ways of data reporting and industry trends and **improved Adoption of AI** (Security trends, 2024) and cloud technologies

9 Acknowledgements

10 References

Collier, K. (2012). *Agile analytics: A value-driven approach to business intelligence and data warehousing.* Addison-Wesley Pearson Education.

Larson, D., & Chang, V. (2016). A review and future direction of agile, business intelligence, analytics and data science. *International Journal of Information Management, 36*(5), 700-710. https://doi.org/10.1016/j.ijinfomgt.2016.04.013

Security Trends: Gallagher's Industry Trends Report 2024. Gallagher Security. https://security.gallagher.com/en/trendsreport

"Information is the oil of the 21st century, and analytics is the combustion engine."
- Peter Sondergaard, Senior Vice President and Global Head of Research at Gartner, Inc.

"Fanning academic knowledge helps guide the industry to fly!"

THE UNIVERSITY OF WAIKATO
Te Whare Wānanga o Waikato

GALLAGHER Security

GLOBAL FARMING SYSTEMS

Sara Ahmad, Ou Wang, Natalie Calvert & Tom Martin

GALLAGHER

THE UNIVERSITY OF WAIKATO
Te Whare Wānanga o Waikato

Background

- The increasing global demand for food production, the environment, and climate change place significant pressure on diverse farming systems.
- This research identifies and explores varied farming practices around the world and how Gallagher product solutions can be applied to farming systems.
- Understanding and addressing the unique challenges faced by farmers across the world is crucial for sustainable agricultural growth, and Gallagher can help identify these challenges.

Research Question

Identify different farming systems across the world and outline how Gallagher product solutions can be applied to the farming systems to solve farming challenges.

???

Methods

1. Conducting an extensive review of global farming systems involved synthesising insights from scholarly articles and case studies.

2. The collaborative approach aimed at innovating solutions utilising Gallagher products.

Results

The results of this research are as follows:

Feedlots face issues of improper manure management and soil quality depletion. Gallagher offers a strategic solution through its Remote Weighing Systems. This innovative technology, developed in collaboration with StrongBo, plays an important role in addressing and mitigating the environmental impact associated with feedlot operations.

- Gallagher's eShepherd virtual fencing enhances regenerative agriculture, rangeland grazing improves with Gallagher's virtual fencing and GPS technologies.
- Rotational grazing benefits are enabled by Gallagher solutions; further efficiency can be achieved through the utilisation of eShepherd technology.

Livestock ranching challenges faced around the world find versatile solutions in Gallagher's water solution. The water management systems help farmers monitor and control irrigation, minimising waste and promoting responsible water usage in agricultural operations.

Implications

▷ The research findings demonstrate how Gallagher products help farmers worldwide to overcome challenges and implement innovative solutions.

▷ Addressing feedlot efficiency, pasture-based systems, and sustainable irrigation, and informing Gallagher products in marketing.

▷ The outcomes of the project are aligned with principles of sustainability, innovation, and resilience in agriculture, with a particular emphasis on adapting to climate change.

Introduction & Research Rationale

Aim of this research:
Use a practical and professional analysis method to conduct an evaluation of the financial sustainability of "Habitat Hectares" (HH) product for Sanctuary Mountain Maungatautari (SMM).

Rationale for research:
The Sanctuary Mountain Maungatautari (SMM) is a mainland ecological island in the North Island of New Zealand (Sanctuary Mountain Maungatautari, 2023). Currently, after the main problems have been coped with, the environmental project is required to find value without compromising the original purpose. In this circumstance, a biodiversity credit product named "Habitat Hectares" (HH product) is planned and issued in 2023 for the first time. Under this vision, the writer is glad to take this valuable chance to provide a product assessment for SMM.

Methodology

Assessment framework
① 3 basic areas have been included --- intangible assets, marketing, and finance.
② A business (financial) plan has been created with an all-link quantitative analysis and detailed marketing strategy in positioning and pricing.
③ Creating a scoring structure (or method) to systematically measure the HH product, which means SMM can to continuously evaluate the performance of the HH product at any time.
④ For the business plan, financial analysis, and pricing forecast model, these algorithmic logic and calculation models are specifically customized for the HH product of SMM. As long as the new data is entered, the Excel table will automatically work out the result, which largely improves the efficiency of financial analysis and reduces the cost of evaluation in the future.
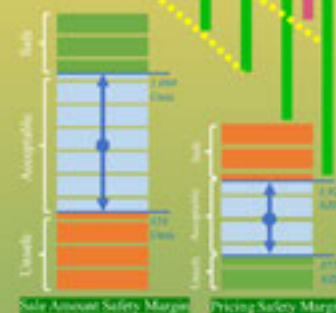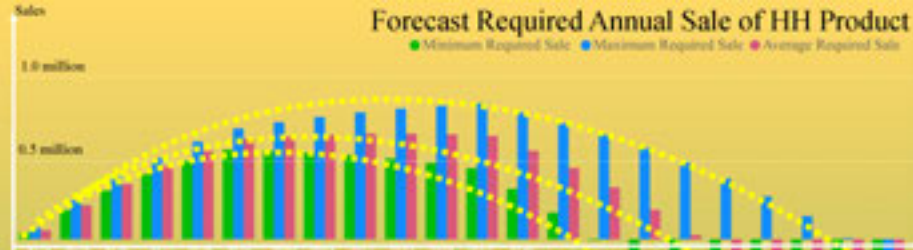
Forward-looking
① Instead of only focusing on the starting stage or several years, this report conducts a financial data mapping throughout the HH product life cycle (22 years).
② Considering the conflict of suitability that comes with high foresight, 2 preparations have been made. Firstly, this report only constructs an original HH-product assessing framework and leaves room for further optimization. Secondly, all critical analysis has been applied with scenario analysis (good-middle-bad).
③ Thus, instead of a number, this report provides a reasonable range of results, which largely increase the suitability and flexibility of the framework.

HH-product-related intangible assets evaluation

D1: To what extent, the intangible assets of SMM will be beneficial for HH products? (score: 5.75)

① In terms of reputation in biodiversity, SMM has many indigenous endangered populations and operates the largest ecological fence in New Zealand. This means SMM can provide the best quality of biodiversity credit, which is an advantage in the market depth.
② The market first-mover advantage is owned by SMM. In 2023, before the biodiversity credit market was built, SMM started to plan and issue the HH products.
③ SMM also has owned the qualification from EKOS, which will greatly reduce the cost of time and capital in entering the market.
④ Compared with Zealandia Te Māra a Tāne, although the tourism business is less commercialized, SMM supports more and wider academic research. For the purpose of entering the professional market, higher research and science achievement is even better than commercialization.

Marketing evaluation

D2: To what extent, the HH product is accessible to the market? (score: 5.75)
The target market has not been fully established, but SMM has a high potential to succeed in this market. Moreover, the market-based model is relatively harder but provides a more tangible and intangible return.

D3: To what extent, does the HH product (or SMM) have a reliable customer group? (score: 7.5)
For customer groups, SMM is very good and professional at creating long-term loyalty among customers. On the other hand, in terms of short-term customers, some marketing development need to be continued. However, the requirements of HH products mainly focus on long-term customers.

D4: To what extent, SMM can use its marketing capability in HH product promotion? (score: 5.75)
For the HH-related marketing capabilities, SMM has significant advantages as well as internal and external difficulties. Therefore, this report tends to suggest a score of 5.75 for this dimension.

Forecast Required Annual Sale of HH Product

Legend: ● Minimum Required Sale ● Maximum Required Sale ● Average Required Sale

Sales: 1.0 million, 0.5 million

Assets Liability Ratio & Equity Ratio
Legend: ● Assets liability ratio ● Equity ratio
(2020, 2021, 2022, 2023)

Capital accumulation rate
Legend: ● Increase ● Decrease ● Total
(2023, 2022, 2021, Total)

Revenue Growth
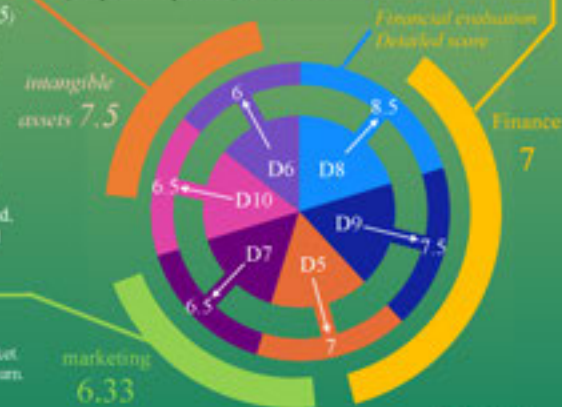Legend: ● Increase ● Decrease ● Total

Sale Amount Safety Margin   Pricing Safety Margin

LONG-TERM FINANCIAL SUSTAINABILITY OF SANCTUARY MOUNTAIN MAUNGATAUTARI
--- EVALUATION OF HABITAT HECTARES PRODUCT

Sanctuary Mountain
MAUNGATAUTARI

Written by
Yixuan Zhang
Supervised by
Vijay Kumar

Conclusion

Through the systemically analysis and scoring, the final score about the HH product and each dimension from different angles is 6.9. Currently, this product is feasible while some conditions can be improved. After the buyout period is optimized, 7.0 is achievable.

Conclusion wheel:
intangible assets 7.5
marketing 6.33
Finance 7
Financial evaluation Detailed score
D6: 6 D8: 8.5 D10: 6.5 D9: 7.5 D7: 6.5 D5: 7

Score evaluation (part)
For a 5-6 score, this product is basically feasible, its benefits overcome its costs.
For a 6-7 score, this product is feasible while some conditions can be improved.
For a 7-8 score, this product is quite feasible and can start at any time.

Financial evaluation

D5: To what extent, the current financial position of SMM is suitable for this product? (score: 7)
Generally, although there are some fluctuations, due to the relatively solid financial foundation and targeted financial needs, SMM is very suitable for the HH product.

D6: To what extent, this product can reduce the pressure of short-term cashflows? (score: 6)
The first year of issuing HH products requires a lower amount of sales and provides surplus cash flow, which means at least it may not increase the pressure of short-term cashflows. However, the huge price increase in the year will create difficulty and pressure.

D7: To what extent, the issuing of this product can be feasible? (score: 6.5)
① Technically, except the year 2 to year 5, the product is highly feasible to be issued.
② The sound capital structure at the moment will be able to reduce (or absorb) some liquidity risk of the cash flow stress between year 2 to year 6.
③ The flexible pricing strategy can also enhance the ability to defend against possible risks.

D8: To what extent, this product can improve the capital structure of SMM? (score: 8.5)
① It will gradually eliminate the dependence on donations for SMM. Moreover, it widens the channels of revenue, which is very helpful for releasing the pressure and risk of the commercial service business.
② This kind of business is very likely to be influenced by the market while the HH product is not (the reason in the bundle selling mechanism).

D9: To what extent, the continuous selling of this biodiversity credit product can be feasible? (score: 7.5)
With the perspective of bundle trading, selling HH products will have an accessible market, customers with similar buying intentions, and many intangible advantages (such as market first-mover advantage).

D10: To what extent, the GPL transaction can be an example of further transaction? (score: 6.5)
① The unit price of the HH product and the total amount of HH-product income fit the prediction from the analysis model which can be assumed as a good start for issuing HH products.
② However, the maturity of the buyout may be too long. This report suggests the maximized buyout maturity is 10 years.

References

Congratulations to all our Summer Research Scholars