

# PROCEEDINGS

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# Foreword

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The Southern Institute of Technology | Te Pūkenga was proud to host the 2022 ITP Research Symposium in Invercargill from 30 November to 2 December. After two years of online symposia because of Covid-19, it was fantastic to be able to hold this event *kanohi ki te kanohi*, and make use of our new SIT Centre for Creative Industries: Te Rau o te Hui. Our ability to come together was particularly welcome as this was the first symposium held after all ITPs formally became business divisions of Te Pūkenga.

This year's conference showcased applied research from across Aotearoa New Zealand and attracted 153 presentations, making it the busiest ITP symposium to date. Presenters hailed from 15 former ITPs, and delivered a diverse mix of traditional research presentations, displays of creative practice, research posters and other formats. We also hosted in-person meetings of new and established applied-research communities of practice, and presented pre-recorded talks from those unable to attend in person. You can read about all the presentations that took place at the symposium in the *Book of Abstracts*, available at <https://doi.org/10.34074/proc.2207>.

The diversity of symposium participants is reflected in these Proceedings, which contain papers from authors across all four regions of Te Pūkenga. The papers are similarly varied, investigating topics around business, information technology, health and wellbeing, and the interfaces between them. Pedagogical research is also well represented, and unsurprisingly a number of papers touch on the recent Covid-related disruptions to education, or focus on topics particularly relevant to Te Pūkenga, such as inclusivity and organisational change. These Proceedings include both longer papers reporting research findings, and shorter practice papers, essays and brief research reports.

The publication of these Proceedings by Unitec's ePress is emblematic of the increasing co-operation among the formerly independent divisions of Te Pūkenga. SIT organised and ran the symposium itself, but ePress has led the editing, review and production of these Proceedings – a task beyond our resources alone. We are grateful for the outstanding work of the ePress staff, without which we could not have offered this publishing opportunity, and for all the symposium participants who seized the opportunity and submitted an article to the Proceedings. We would also like to thank the dozens of academics who contributed their time to peer reviewing for the symposium – especially those that reviewed the articles herein, but also everyone who reviewed presentation abstracts submitted to the symposium. Neither the symposium nor these Proceedings would have been possible without this collegial service, and the input from reviewers is reflected in the quality of the talks and articles presented.

The year leading up to the symposium was a pivotal one for the vocational education sector in Aotearoa New Zealand, as it saw the official conversion of all 16 Institutes of Technology and Polytechnics and nine Industry Training Organisations into business divisions of Te Pūkenga. Since the symposium took place at the end of 2022, the hard work has begun of restructuring these formerly independent organisations into the four regions and national functions of Te Pūkenga. Although these changes will likely mean that no ITP Symposium takes place in 2023, we look forward to its return as a national Te Pūkenga Symposium in 2024.

# Exploring the Role of Virtual Simulation Gaming in Reducing Physical Examination Anxiety for Undergraduate Nurses

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## Research Report



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## ABSTRACT

Simulated objective structured clinical examination (OSCE) assessments have traditionally evoked high levels of anxiety for students, both when learning the scenarios in face-to-face simulations and when undertaking the actual OSCE assessment. Virtual simulation gaming (VSG) is an identified method of preparation for simulation that may reduce performance anxiety for students undertaking OSCE assessment. This quantitative exploratory research utilised established satisfaction and anxiety/confidence scales to explore the impact of VSG on student perceptions of simulation experiences, anxiety and self-confidence in clinical decision-making. Summative OSCE assessments were conducted in two cohorts before an inpatient and ambulatory care clinical practicum. Cohort one undertook their summative OSCE assessment immediately following the initial teaching, with the second cohort completing a mental health and addictions clinical practicum before their summative OSCE. Descriptive and inferential statistics were used to examine the relationships between simulation satisfaction, students' perceived anxiety, and confidence with clinical decision-making. Self-reported satisfaction with simulation levels were high and improved over subsequent simulations. Results showed that although the second cohort demonstrated higher levels of confidence in clinical decision-making, there was no significant difference in anxiety levels between the two cohorts. This suggests that OSCE-related anxiety is situational rather than directly related to self-confidence. Anxiety was reported by most students following summative OSCEs despite the introduction of VSGs in pre-OSCE clinical simulation preparation. Even though they had high satisfaction with the simulation experience and reported feeling confident, this did not allay student anxiety. Overall, the study did not identify any measurable factors that would indicate which students would score high in self-confidence and/or anxiety. While it was not possible to directly attribute high levels of self-confidence to the introduction of VSGs, student satisfaction with simulation and clinical learning that included VSGs was high, indicating the positive effect on learning.

## KEYWORDS

Simulation-based learning, nursing education, virtual simulation gaming, clinical decision-making, clinical practicum

## INTRODUCTION

Simulation-based learning (SBL) is a teaching and learning strategy used in nursing education to provide students with the opportunity to practice clinical skills and develop clinical decision-making in a controlled setting (Gaba, 2004; Lioce et al., 2020). Simulated objective structured clinical examination (OSCE) is one way of assessing students' competence and safety to practice prior to clinical practicums. For nursing students, the stakes are high, as outcomes of their OSCE assessment may affect their progression through the Bachelor of Nursing degree. Recognising the effect OSCEs have on students, we introduced virtual simulation games (VSG) as preparation for formative face-to-face simulation sessions run in the weeks leading up to the OSCE assessment. The aim of the VSG was twofold – firstly to develop clinical decision-making in a safe way, secondly, through this process, to assist students to develop self-confidence to help reduce examination anxiety.



This paper presents research data collected as a formal evaluation of the efficacy of the VSG initiative. The research aims are provided below, followed by a description of the context – Year Two Bachelor of Nursing students preparing for their OSCE assessments – and a rationale for the introduction of VSGs as a preparation strategy. The methodology, data collection and analysis tools are described, followed by the results and implications for nursing education teachers. Limitations are noted, as is the opportunity for further research, with a final conclusion that asserts the value of VSGs, while underscoring the complex range of factors which affect anxiety, and confidence.

## RESEARCH AIMS

The purpose of this study was to explore student perceptions of satisfaction with simulation, self-confidence in clinical decision-making (CDM), and anxiety about simulated OSCE assessments following the introduction of VSGs to better prepare students psychologically for simulation and reduce simulation/exam anxiety associated with Year Two summative OSCE assessments.

The aim of this research was to analyse:

- Nursing student satisfaction with simulation following VSG pre-simulation preparation
- Nursing student perception of VSG and clinical simulation labs on CDM during OSCE assessment
- The impact of simulation preparation on student anxiety relating to OSCE assessment

## BACKGROUND

Simulation-based learning (SBL) prepares nursing students for workplace learning in the clinical setting (Kardong-Edgren et al., 2020; Miller & Guest, 2021). Studies have shown that students completing SBL prior to clinical practicums demonstrate decreased anxiety and increased self-confidence, leading to improved clinical performance (Neilson & Harder, 2013; Woda et al., 2019). Virtual simulation gaming (VSG) is one identified method of SBL that aids in the development of clinical decision-making (CDM) in nursing (Luctkar-Flude et al., 2021; Verkuyl & Hughes, 2019). In Year Two of a Bachelor of Nursing course, students complete an initial course that includes hybrid medium-fidelity clinical laboratories where clinical skills and clinical decision-making are applied to a simulated patient scenario. After this preparatory learning, students complete a summative OSCE assessment where 'safety to practice' elements are assessed against the Nursing Council of New Zealand competencies for registered nurses at a Year Two level (Te Kaunihera Tapuhi o Aotearoa Nursing Council of New Zealand, 2022).

OSCE assessments within the Year Two course have traditionally evoked high levels of anxiety for students, both when learning the scenarios in clinical labs and when undertaking the actual OSCE assessment. Anxiety can impair students' ability to learn and perform, especially in a simulation (Shearer, 2016; Zhang & Walton, 2018). This is reflected in findings by Cobbett and Snelgrove-Clarke (2016), Nielson and Harder (2013) and Gore et al. (2011) relating the simulation anxiety experienced by students as comparable to examination anxiety, regardless of the formative or summative aspect of the simulation. The use of web-based teaching such as VSGs has been shown to improve student self-confidence and reduce anxiety associated with CDM (Bektaş & Yardimci, 2018). Studies have shown that virtual simulation can be just as effective as face-to-face simulation in building student confidence, with the added benefit of allowing students to repeat the experience multiple times (Luctkar-Flude et al., 2021).

It is clear that pre-simulation preparation is a crucial aspect of nursing simulation, highlighting its importance in improving student outcomes and satisfaction (Dileone et al., 2020; Leigh & Steuben, 2018; Shearer, 2016). However, it appears that learners may not always complete pre-simulation activities, indicating a need for strategies to encourage engagement with these tasks (Tyerman et al., 2019; Verkuyl & Hughes., 2019). Virtual simulation games have been identified as a potentially valuable tool for preparing students for clinical lab-based simulation, as gaming is perceived by students as more engaging compared to static case studies (Cobbett & Snelgrove-Clarke, 2016; Luctkar-Flude et al., 2021). The accessibility and flexibility of web-based education make it an effective method

for making simulation learning accessible on and off campus and at a time and place that suits the student (Bektaş & Yardimci, 2018; Verkuyl et al., 2017).

VSGs are serious games designed for educational purposes, depicting real-world events and designed for specific learning outcomes (Lioce et al., 2020). To address the students' lack of preparation for simulation within the Year Two course, three pre-simulation VSGs were developed to provide students with an opportunity to familiarise themselves with simulation scenarios and practice clinical decision-making (Sadd & Hills, 2021). The three VSGs used in this research form part of the pre-simulation online preparation prior to clinical laboratory-based hybrid medium-fidelity simulation and simulation OSCEs. Each VSG directly reflects one of three simulation scenarios developed, refined and used in clinical simulations and OSCEs over the previous three years of the Year Two course.

Each VSG replicates the OSCE simulation scenarios encountered during clinical lab simulation, challenging students with five key decision-making points in each scenario. Scenario-based role modelling is a successful strategy in nursing education and SBL (Coram, 2016), and VSGs offer a way to role-play the correct decisions once the student has made their choice within the game. By replicating face-to-face simulation scenarios in a different format, VSGs provide students with an opportunity to consider their decisions and reinforce their CDM in preparation for OSCE assessment. Students have the opportunity to return to the VSG after clinical simulation to further practice their CDM in preparation for their summative OSCE assessment. Each virtual pre-simulation game is made available in preparation for face-to-face simulation, remaining available until the summative OSCE. This provides students the opportunity to prepare and cognitively practice their decision-making within each scenario, enabling students to determine when, and how, they do their learning.

## METHODS

The research uses a quantitative cross-sectional exploratory design with two survey instruments collected from two sites, using purposive sampling. All students were provided with access to the three VSGs, but only those who consented and completed the surveys were included in the research.

Two survey instruments were used to collect data:

- The Satisfaction with Simulation Experience Scale (SSES, adapted with permission; Levett-Jones et al., 2011) was used to evaluate student perceptions of clinical simulation labs and OSCE assessments. The adapted questionnaire was used to collect data on student experiences using VSG as pre-simulation preparation following each of the three clinical simulation labs.
- The Nursing Anxiety and Self-Confidence with Decision Making Scale (NASC-CDM) (White, 2011) was completed post-OSCE assessment in two cohorts. The NASC-CDM has been widely used in nursing education research to assess student-nurse anxiety relating to simulation and clinical practice settings.

Ethical approval was gained from the institute's Research and Human Ethics Committee, approval number TRC 2020.094. A participant information sheet was provided before the commencement of the research and informed consent was gained before completing surveys.

### Data collection

Clinical labs, which include hybrid medium-fidelity simulations, take place during the first seven weeks of the year. These simulations focus on respiratory, cardiac and neurological scenarios, and are conducted in weeks three, five and six, respectively. Each related pre-simulation virtual simulation game (VSG) is available to students from the week prior to the face-to-face simulations. Following each simulation, SSES data was collected.

Table 1. Delivery format.

Week	1	2 Resp VSG available	3	4 Cardiac VSG available	5 Neuro VSG available	6	7	8	9-17	18
All students	Skills Labs	Skills Labs	Hybrid sim – resp scenario	Skills Labs	Hybrid sim – cardiac scenario	Hybrid sim – neuro scenario	Skills Labs			
			SSES survey – resp scenario		SSES survey – cardiac scenario	SSES survey – neuro scenario				
Cohort 1 only								OSCE exam Cohort 1	Acute Inpatient placement	
								Cohort 1 NASC-CDM		
Cohort 2 only								Mental Health placement / Study block	OSCE exam Cohort 2	
									Cohort 2 NASC-CDM	

After the initial preparation in weeks one to seven, students are divided into two clinical (practicum) cohorts. The first cohort (n = 43, Cohort 1) was assessed by an Objective Structured Clinical Examination (OSCE) in week eight. NASC-CDM data was collected for this group at this point. The second cohort (n = 38, Cohort 2) underwent a combination of study leave and a Mental Health practicum placement lasting ten weeks, during which the simulation labs and VSGs were available for practice. Following the completion of the Mental Health practicum, Cohort 2 was assessed by an OSCE exam prior to commencing their Inpatient and Ambulatory Care practicum. NASC-CDM data was collected for the second cohort at this point.

## Data analysis

Descriptive and inferential statistics were used for data analyses of SSES and NASC-CDM data using the IBM statistical program Statistical Package for Social Sciences (SPSS), Version 28.0 (IBM Corp, NY). Demographic data was collected from the NASC-CDM (Figure 1).

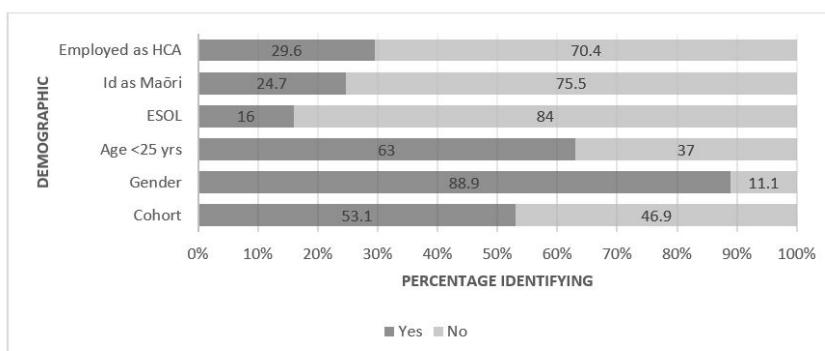


Figure 1. Demographic data (NASC-CDM).

Note: For analysis purposes, demographic data has been presented here as Yes/No, other than gender (Female:Male) and Cohort (1:2).

## RESULTS

Descriptive statistics, including frequencies, median and distributions, were analysed separately. Non-parametric tests such as Spearman rho, Kruskal-Wallis and Mann-Whitney U were used to examine relationships and differences in groups.

### Satisfaction with Simulation Experience Scale (SSES)

The SSES scale, developed by Levett-Jones et al. (2011), evaluates student satisfaction with simulation. The questions were adapted (with permission) to include VSG. Eighteen questions are presented using a Likert scale ranging from 1 (Strongly disagree) to 5 (Strongly agree), using three subscales: debrief and reflection, clinical reasoning and clinical learning. The subscales of clinical reasoning and clinical learning were combined for analysis and labelled 'clinical reasoning and learning'.

The SSES debrief and reflection subscale includes questions 1–9, with a possible score range of 9–45. For example, "Reflecting on the virtual pre-simulation game enhanced my learning" and "I received feedback during the virtual pre-simulation game that helped me to learn." The clinical reasoning and clinical learning subscales include questions 10–18, with a possible score range of 9–45. For example, "The virtual simulation game enabled me to demonstrate my clinical reasoning skills during the simulation" and "The virtual simulation game and simulation helped me to recognise my clinical strengths and weaknesses."

Internal consistency of variables was checked against Levett-Jones's (2011) reported Cronbach alpha of .776 for debrief and reflection, .988 for clinical reasoning, and .850 for clinical learning. The Cronbach alpha on this study was .889 for debrief and reflection. The subscales of clinical reasoning and clinical learning were combined and had a Cronbach alpha of .917, indicating very good internal consistency of both subscales (Cohen, 1998).

The median debrief and reflection scores (Md = 36, IQR = 32, 39) indicate students were generally "Unsure" or "Agreed" with statements about their debrief and reflection experiences following virtual pre-simulation games and simulation. Students generally "Agreed" that virtual simulation games supported their clinical reasoning and learning (Md = 41, IQR = 36, 45). Median scores for each scenario indicate students' levels of satisfaction with debrief and reflection and clinical reasoning/clinical learning were consistent for each (Table 2).

Table 2. Satisfaction with Simulation Experience Scale (SSES) median values.

N		Total DBL	Total CRL	Total respiratory DBL	Total respiratory CRL	Total cardiac DBL	Total cardiac CRL	Total neurological DBL	Total neurological CRL
	Valid	218	218	66	66	82	82	70	70
	Missing <sup>a</sup>	28	28	16	16	0	0	12	12
Median		36.0	41.0	41.0	40.5	40.5	40.5	40.5	41.0
Inter-quartile range <sup>b</sup>		32.0–39.0	36.0–45.0	36.0–43.25	37.0–44.0	36.0–44.0	36.0–44.0	36.0–45.0	36.5–45.0

Note: DBL refers to debrief and reflection questions 1–9; CRL refers to combined clinical reasoning and clinical learning questions 10–18.

<sup>a</sup> Missing scores account for varying numbers of students attending and completing surveys each time.

<sup>b</sup> Possible score range 9–45.

## Nursing Anxiety and Self-Confidence with Clinical Decision Making (NASC-CDM) Scale

The NASC-CDM (White, 2011, with permission) has been widely used in nursing education research to evaluate student-nurse anxiety related to simulation and clinical practice settings. The questionnaire was completed post-OSCE assessment by 81 out of 102 participants.

The NASC-CDM used a Likert scale of 1 = Not at all; 2 = Just a little; 3 = Somewhat; 4 = Mostly; 5 = Almost totally; 6 = Totally. Questions include statements such as "I am \_\_\_\_\_ self-confident and \_\_\_\_\_ anxious in my ability to ask the client additional questions to get more specific information about the current problem" and "I am \_\_\_\_\_ self-confident and \_\_\_\_\_ anxious in my ability to correlate physical assessment findings with the client's nonverbal cues to see if they match or don't match."

White's (2011) NASC-CDM scale has a Cronbach's alpha coefficient reported as .97 for self-confidence and .96 for anxiety subscales, indicating very good internal consistency (Cohen, 1998). The SC-CDM in this study has a Cronbach's alpha of .96 for self-confidence and .96 for anxiety.

After the OSCE assessment, the NASC-CDM scale was used for participants to self-assess their self-confidence and anxiety with CDM. Demographic data was analysed using frequency counts for categorical variables. The Likert items on the survey were grouped into two composite score scale variables: 'total self-confidence' (SC) (possible range 27–162) and 'total anxiety' (possible range 27–162). This allowed the data to be analysed as interval data using the means as a measure of central tendency. The median self-confidence score (Md = 112, IQR = 100, 129.5) indicated students were "mostly" self-confident, while the median anxiety score (Md = 62, IQR = 56, 80) indicates students were "just a little" to "somewhat" anxious in their ability (Table 2).

Table 3. NASC-CDM median values.

N		Total SC	Total anxiety
	Valid	81	81
	Missing <sup>a</sup>	0	0
Median		112.0	62.0
Inter-quartile range <sup>b</sup>		100.0–129.5	56.0–80.0

Note: SC refers to self-confidence with decision-making.

<sup>a</sup> Missing scores account for varying numbers of students attending and completing surveys each time.

<sup>b</sup> Possible score range 27–162.

## Relationships

Spearman Rank Order Correlation (Spearman rho) was used to examine relationships between the level of satisfaction between debrief and reflection (DBR) and clinical reasoning and learning (CRL) (SSES); and to explore relationships between self-confidence with clinical decision-making (SC) and anxiety (White, 2011, NASC-CDM).

A strong, positive correlation ( $\rho = .739$ ,  $n = 218$ ,  $p < .001$ ) was found between levels of satisfaction with DBR and CRL. The relationship between SC and anxiety was examined separately for each cohort. A medium, negative correlation was found between self-confidence with clinical decision-making and reported anxiety ( $\rho = -.384$ ,  $n = 43$ ,  $p < .005$ ) for the first cohort. However, there was only a small non-significant negative correlation for the second cohort ( $\rho = -.38$ ,  $n = 43$ ,  $p = .05$ ).

## Exploring groups

There were no statistically significant differences in self-confidence levels between Cohort 1 and Cohort 2, as indicated by the non-significant Mann-Whitney U test result ( $U = 768.5$ ,  $z = -.459$ ,  $p = .646$ ,  $r = .05$ ). However, there was a small difference in anxiety levels between the two cohorts, with the second cohort reporting slightly lower anxiety levels than the first cohort, although this difference was also not statistically significant ( $U = 721.5$ ,  $z = -.904$ ,  $p = .366$ ,  $r = -.10$ ).

Additionally, the demographic variables of age, English for speakers of other language (ESOL) status, identification as Māori, or previous experience as a healthcare assistant (HCA) did not show any significant differences in the study's variables.

## DISCUSSION

The purpose of this study was to explore student perceptions of satisfaction with simulation, self-confidence in clinical decision-making (CDM) and anxiety about simulated OSCE assessments, following the introduction of VSGs as a preparation tool for Year Two summative OSCE assessments.

Students in this study had high levels of satisfaction with simulation following VSG pre-simulation preparation, accompanied by high levels of self-confidence for clinical decision-making on the summative OSCE assessment. The results of this study show a strong positive correlation between student perception of VSG and clinical simulation on clinical decision-making during OSCE assessment. High levels of satisfaction with debrief and reflection related to high levels of satisfaction with clinical learning and reasoning. Research has shown that preparation for simulation does increase confidence and decrease anxiety (Luctkar-Flude et al., 2021). Similarly, when comparing in-person clinical simulation and VSG, Verkuyl et al. (2017) also report high levels of satisfaction for both formats.

In the first cohort of this study to complete their summative OSCE, results show a strong correlation between high levels of self-confidence and lower levels of anxiety for students, indicating performance anxiety was balanced by students' confidence and familiarity with the simulation scenarios. These findings reflect those of White et al. (2019), who found that students completing the NASC-CDM reported higher levels of self-confidence and lower levels of anxiety with CDM related to the use of innovative teaching pedagogy, such as simulation and interactive classrooms. In a systematic review, Tyerman et al. (2019) conclude that pre-simulation supports the development of confidence and competence while reducing performance anxiety associated with simulation.

The second cohort completed the pre-simulation VSGs and in-class formative simulations at the same time as the first cohort. Their summative OSCE assessment was not held until they had completed a Mental Health clinical practicum and study block. The clinical experience likely helped develop their communication skills and related self-confidence. However, for the second cohort, high levels of self-confidence did not correlate to lower levels of anxiety, indicating these students experienced anxiety related to the situational performance anxiety of the OSCE assessment. While the students in the second cohort did have time and opportunity to practice their OSCE scenarios and VSGs were available during this time, the higher levels of anxiety in the second cohort may also be related to the time elapsed since being face to face and participating in the simulations.

Literature has long identified a relationship between anxiety, memory and performance (Shearer, 2016; Ansari & Derakshan, 2010). This relationship is known as Yerkes and Dodson's Law, commonly referred to as the inverted-U curve (Yerkes & Dodson, 1908), which represents the point where performance peaks before declining as anxiety increases (Faller et al., 2019). Al-Ghareeba et al. (2019) found that anxiety could have both positive and negative effects on learners' performance during simulation activities, with Nielson and Harder (2013) suggesting that it could enhance motivation and performance up to a certain point, beyond which it could lead to a decrease in performance. Performance anxiety can lead to a negative feedback loop, where poor performance can increase anxiety, leading to further poor performance, and so on (Yerkes & Dodson, 1908). This can be particularly detrimental in high-stakes situations, such as simulation and OSCE assessments.

While simulation is meant to be a formative experience, nursing students still experience anxiety similar to physical examination anxiety (Al-Gareeba et al., 2019). This is exacerbated when the simulations then form the summative OSCE assessments (Zhang & Walton, 2018). A systematic review by Oliveira et al. (2013) found that preparation and pre-briefing play an important role in students' anxiety and confidence in their decisions and actions, findings that are reflected in this study when OSCEs follow a simulation format. Virtual pre-simulation games provide students the opportunity to prepare for simulation, increasing familiarity with simulation scenarios, and potentially increasing their confidence with clinical learning and reasoning, and decision making. The median ranges of self-confidence and anxiety scores in this study indicate most students were in the performance-anxiety range of the U-curve. In the first cohort of this study to complete their summative OSCE, NASC-CDM results showed a strong correlation between high levels of self-confidence and lower levels of anxiety for students, indicating performance anxiety was balanced by the student's confidence and familiarity with the simulation scenarios. These findings reflect those of White et al. (2019), who found that students completing the NASC-CDM reported higher levels of self-confidence and lower levels of anxiety with CDM related to the use of innovative teaching pedagogy, such as simulation and interactive classrooms. However, for the second cohort, high levels of self-confidence did not correlate to lower levels of anxiety, indicating these students experienced anxiety related to the situational performance anxiety of OSCE assessment (Zhang & Walton, 2018). The higher levels of anxiety in the second cohort may also be related to the time elapsed since being in class, contrasting with Woda et al. (2019), who reported that students completing simulation-based learning prior to clinical practicums demonstrate decreased anxiety and increased self-confidence, leading to improved clinical performance.

Overall, the study did not identify any measurable factors that would indicate which students would score high in self-confidence and/or anxiety. In terms of differences between groups, no significant findings were identified within or between groups for satisfaction with debriefing and reflection, satisfaction with clinical reasoning and clinical learning, self-confidence, and anxiety. This indicates that the factors of cohort, age, identification as Māori, English as a second language, and HCA experience did not have a significant impact on these variables.

## Limitations

This study used validated survey tools (White et al., 2011; Levett-Jones et al., 2011). Both instruments collected self-assessed data from nursing students, providing insight into their experiences and perceptions. One tutorial group was not given an SSES survey to complete after their first formative simulation, as data collection was reliant on teachers distributing the surveys. However, sufficient data was still available for analysis. Potentially, collecting SSES data following the summative OSCE may have provided an opportunity to directly compare SSES and NASC-CDM data. Findings may have been enhanced through the evaluation of learning such as through pre- and post-tests. This would provide a clearer measurement of the effects of VSG on learning and allow for a closer examination of the differences between the first and second cohorts. Therefore, this study was unable to measure the impact of VSG on performance. Further study into how students experience anxiety during simulation and OSCE would be useful in managing performance anxiety for OSCE assessments.

## Implications for practice

Many forms of simulation may induce anxiety, which has been implicated in both positive and negative effects on performance. This can be exacerbated when simulation becomes a summative assessment such as an OSCE. Some studies suggest that increased stress and anxiety levels can enhance retention and learning pathways (Nielsen & Harder, 2013). However, anxiety may also lead to decreased performance and learning. Educators should be aware of the causes of student anxiety during simulation to moderate anxiety levels and enhance learning (Nielsen & Harder, 2013). Preparation for simulation is an essential component, yet there is limited research into effective pre-simulation preparation (Tyerman et al., 2019). Pre-simulation VSGs provide a way for students to familiarise themselves with the simulation and to practice their clinical decision-making skills prior to and following the simulation. Educators need to recognise the anxiety that students may encounter during simulation activities and OSCE assessments, and consider any contributing factors that could potentially result in inadequate performance.



There may be an optimal level of anxiety (arousal) that can enhance performance, and this may vary depending on the individual and the task at hand (Al-Ghareeba et al., 2019; Shearer, 2016). It is important for educators to be aware of the potential effects of anxiety on learning and performance, and to strive to create a safe and supportive learning environment that minimises anxiety while still challenging students to learn and grow. While a decrease in students' reported anxiety can be an indication of the effectiveness of simulation, it should be noted that other factors can also impact anxiety levels, such as individual differences, external stressors and environmental factors (Gore et al., 2011). Therefore, it is important to use multiple measures to assess the effectiveness of simulation, such as objective performance measures, qualitative feedback and clinical outcomes.

## **CONCLUSION**

Overall, this study highlights the importance of exploring the relationship between various factors that may impact nursing students' learning and performance. While some relationships were identified, further research is needed to identify measurable factors that can predict self-confidence and anxiety in nursing students. It is important to identify triggers of anxiety during simulation activities and OSCE assessments to help reduce and manage student anxiety. Even with the introduction of virtual pre-simulation games for preparation as a cognitive learning method, student anxiety with summative OSCE assessments remains high, despite reporting high self-confidence. Exposure to the clinical workplace environment did not reduce the anxiety with a simulated practical OSCE exam.

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## **ABBREVIATIONS / ACRONYMS**

OSCE – objective structured clinical examination  
SBL – simulation-based learning  
SC – self-confidence  
VSG – virtual simulation game  
DBR – debrief and reflection  
CRL – clinical reasoning (and clinical) learning  
NASC-CDM – nursing anxiety and self-confidence with clinical decision-making  
SSES – satisfaction with simulation experience scale



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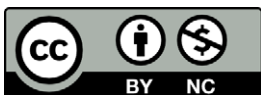
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# What is Best Practice When Creating Realism for Mental Health Scenarios in Aotearoa New Zealand Undergraduate Nursing?

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## Research Report



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## ABSTRACT

Simulation scenarios are commonly used in nursing education, but to a lesser extent in mental health (MH) nursing. The aim of this scoping review was to assess the evidence investigating MH nursing simulations in tertiary education settings to consider best practice in developing realistic MH scenarios. A scoping review of full-text peer-reviewed journal articles published between 2016 and 2021, which were available on Clarivate Web of Science, Ovid, Scopus, EBSCO (including PubMed), ProQuest and Google Scholar, was conducted using predefined criteria. A total of 16 articles based on the criteria were considered for review. The data collected showed positive results of simulations, including a decrease in undergraduate nurses' MH anxiety or stigma following simulation; however, there was a strong leaning towards students' self-reported experiences of simulation rather than quantifiable standardised measures. More empirical research is needed on how to provide MH simulations in undergraduate nursing programmes, while, at the same time, building on their effectiveness.

## KEYWORDS

Scoping review, simulation, undergraduate nursing, mental health

## INTRODUCTION

In Aotearoa New Zealand, the demand for mental health (MH) services is growing, exacerbated by the impact of the Covid-19 pandemic. The New Zealand Government's (2018) report *He Ara Oranga: Report into the Government Inquiry into Mental Health and Addiction* states the international data shows that in countries comparable to Aotearoa, 35–50% of people with a mental illness receive no treatment. The report defines mental illness as being on a "spectrum from mild distress through to enduring psychiatric illness that requires ongoing interventions" (p. 208). This report contains a series of recommendations for improving MH and addiction care, including broadening the range of services and improving responsiveness in primary care. However, the *Nursing Cohort Report: A Longitudinal Study of New Zealand and Internationally Qualified Nurses* (Nursing Council of New Zealand, 2021) reveals that, of nurses who qualified in Aotearoa, 11.2% work in MH settings, inclusive of intellectual disability, addiction, MH community and inpatient services. Only 4.6% of internationally qualified nurses work in MH settings. As these services are understaffed, there will be an ongoing shortage of MH nurses who are able to provide the preceptorship required for students' clinical learning experiences.

Over the last few decades, simulation has been found to enhance students' clinical learning experience, as it provides opportunities for students to experience more realistic clinical-practice situations. Simulation improves students' critical thinking, clinical knowledge and skill acquisition, which in turn improves student satisfaction and confidence (Carrero-Planells et al., 2021; Lapkin et al., 2010; Burns et al., 2010).

Simulation in undergraduate nursing has developed from the anatomical models first used in 19th-century classrooms and, nowadays, advances in simulation modalities have enabled realistic representations of MH care, consumers and situations (Singleton, 2020). For example, MASK EDTM (where an educator wears a realistic silicone mask or other body parts) and virtual simulation enable enhanced realism of an actual patient. There are also medium-fidelity computerised mannequins that can breathe, have heart, lung, blood pressure and bowel sounds, and allow for nasogastric and urethral tube insertion. Higher-fidelity mannequins have physiologic responses to

learner actions with airway management features, urinary and/or wound drainage, and intravenous access, and can also have seizures and pupil changes (Decker et al., 2008). Today these mannequins can also have a variety of skin textures and other realistic features such as wounds and oedema (McAllister et al., 2013; Laerdal, n.d.). As Jeffries (2007) states, the aim of simulation is to recreate an event or situation resembling clinical practice. A mannequin represents a patient's physical presentation, while a simulated patient (SP) can present an individual who encompasses the illness experience with emotion and behaviour. A definition of an SP includes the use of a healthy person portraying a specific role as tāngata whaiora (patient) or a patient's relative (whānau). SPs are used in simulated scenarios as a teaching tool because they are effective in developing students' professional responsibility and interpersonal relationships (Wordsworth & Rodrigues 2018).

An increased demand for the use of simulation in undergraduate nursing programmes in the USA led to nursing schools requesting permission for clinical experience hours to be replaced by simulation. In their longitudinal randomised controlled study, Hayden et al. (2014) found that substituting high-quality simulation experiences for up to half of traditional clinical hours in pre-licensure nursing education produced comparable end-of-programme educational outcomes and new graduates ready for practice. Other studies have also found that teachers and students alike prefer simulations to conventional lectures, while students get to practice and perfect their clinical skills as well as implement theoretical knowledge on practice (Carerro-Planells et al., 2021; Green et al., 2022)

## AIMS

Nursing Education in the Tertiary Sector (Aotearoa New Zealand) (NETS) commissioned research in 2015 that aimed at identifying the key learning outcomes for scenario-based simulated clinical learning experiences to inform the development of nationally standardised and validated scenarios for clinical learning. Educators and senior nurses in this study rated learning outcomes related to professional responsibility and interpersonal relationships as important in simulated learning experiences in undergraduate nursing programmes (Wordsworth et al., 2014). This led to the question: "How can one tertiary educational institution develop simulation for teaching MH?" This generated the need to establish the best practice for realism in MH scenarios and, to do so, a thorough understanding of the literature was needed. In this study we used the definition of mental illness provided by the New Zealand Government (2018) which refers to cognitive, rather than intellectual mental health concerns.

## METHODS

A systematic literature search was conducted in November 2021, using the databases MEDLINE, Clinicalkey, Cochrane Library EBSCO suite, Ovid, ProQuest, Web of Science, Scopus and Google Scholar. The search terms used were based on the research question and sub-questions. Search terms included 'mental health', 'undergraduate nur\*', 'undergraduate nursing OR undergraduate nurse', 'scenario training simulation', 'best practice', 'fidelity OR realism'. 'Realism' and 'fidelity' were used initially together and then separately, while 'best practice' was excluded initially to create a landscape of the literature on MH simulation, but it was later included in a second literature search, and this uncovered new information. The number of results and search terms used in the individual databases is reported in Table 1. Literature was excluded from the search if it was not peer reviewed, was unavailable in English, the full text was unavailable, it was published prior to 2016, included non-nursing undergraduate experience and discussed postgraduate or in-work scenarios.

## RESULTS

After the literature search, there were 1514 results, which were narrowed to only 20 that met the research criteria, then 16 because of paper repetition across databases. The participants in the research studies or reviewed research studies only included undergraduate nursing students (henceforward, UGNS).

Table 1. Literature scoping and search terms.

Database	Searches	Results	Results when limits applied
Clarivate Web of Science (Web of Science Core Collection, MEDLINE)	Search 1: [Topic] "mental health" AND [Topic] "scenario training" AND [Topic] "undergraduate nurses OR undergraduate nursing" (10/11/2021)	4	4
	Search 2: [Topic] "mental health" AND [Topic] "high fidelity OR realism simulation" AND [Topic] "best practice" AND [Topic] "undergraduate nurses OR undergraduate nursing" (18/11/2021)	0	0
Ovid	"mental health simulation" "undergraduate nursing" "best practice" (16/11/2021)	971	4
Scopus	[Title-abstract-keyword] "mental health" AND [Title-abstract-keyword] "undergraduate nur*" [Title-abstract-keyword] "scenario training OR simulation"	8	2
EBSCO (including PubMed)	Search 1: "mental health" AND "undergraduate nur*" AND "scenario training OR simulation" (11/11/2021)	66	3
	Search 2: "mental health" AND "undergraduate nur*" AND "scenario training OR simulation" AND "fidelity" (11/11/2021)	7	3
	Search 3: "mental health" AND "undergraduate nur*" AND "simulation" AND "best practice" (19/11/2021)	3	0
ProQuest	Search 3: "best practice" AND "Mental Health" AND "undergraduate nursing" AND "simulation" (18/11/2021)	443	4 (due to duplication)
Google Scholar	Search 1: [Topic] "mental health" AND [Topic] "undergraduate nursing" AND "scenario training OR simulation" AND "fidelity OR realism" (11/11/2021)	9	0
	Search 2: [Topic] "mental health" AND [Topic] "undergraduate nursing" AND "simulation" AND "best practice" AND "Zealand" (18/11/2021)	0	0
	Search 3: Search 2: [Topic] "mental health" AND "undergraduate nursing" AND "training OR simulation" AND "best practice" AND "zealand"	3	0

## STUDY CHARACTERISTICS

A total of 1554 UGNS participated in the literature reviews and research studies. Most studies were undertaken in the USA (n = 7) or the USA with another country (n = 1), Australia (n = 3) or Australia with another country (n = 1), followed by Norway, Canada, Singapore and Spain with one study per country. Studies were quantitative, qualitative, mixed methods and included the following research designs: quasi-experimental (n = 3), descriptive evaluation, qualitative description, sequential explanatory design, e-delphi design, integrative literature review, literature review, scoping review, observations, integrative learning design, multisite studies, and cross-sectional surveys.

## DISCUSSION

Most studies reported numerous benefits of SP use in the undergraduate nursing curriculum, including increased student confidence and interpersonal communication skills (Alexander et al., 2018; Donovan & Mullen, 2019; Goh



et al., 2016; Kunst et al., 2018; Øgård-Repål et al., 2018; Thompson Martin & Chanda, 2016; Witt et al., 2018). Some researchers were more hesitant to stress the significance of their findings due to several reasons, including the lack of definition of terms (Sedgwick et al., 2020), no longitudinal follow-up (Kunst et al., 2018), or the small sample size (Speeney et al., 2018; Witt et al., 2018). Some researchers also made a number of suggestions for improving MH SP scenarios, which are reported in the following section, but, firstly, the standardised best practice tools used in the literature are described.

## Drawing on independent nursing body and simulation frameworks

The standards of independent bodies, such as the Association for Standardized Patient Educators (ASPE) and International Nursing Association for Clinical Simulation Learning (INASCL), were used in the literature. The ASPE standards of best practice in simulation list five domains including “safe work environment; case development; SP training for role portrayal, feedback, and completion of assessment instruments; program management; and professional development” (Association for Standardized Patient Educators, n.d., para. 1). Alongside these are five values, including “safety, quality, professionalism, accountability and collaboration” (para. 1). The INASCL standards laid down set and expected criteria for teaching simulations, including such things “as constructing a measurable output [and] designing a scenario that provides a context for simulation learning” amongst a plethora of other criteria (INASCL Standards Committee, 2018, p. 55). Established models/theories, such as the National League of Nursing (NLN) simulation framework, were also employed, which can be used to evaluate simulation-based clinical activities (Cowperthwait, 2020).

Witt et al. (2018) used the Nursing Education Simulation framework and the International Nursing Association Clinical Simulation and Learning Standards of Best Practice – Simulation, which directed the design, development and implementation of the simulation-based learning activity. Witt et al. (2018) conducted a post-simulation survey (six Likert and five open-ended responses) with 32 UGNS from one nursing programme in the USA, who participated in an MH scenario. The researchers stated that students agreed SP simulation made them feel confident in communicating with people affected by mental distress.

Dunn and Riley-Doucet (2017) utilised Jeffries’ simulation theory, which the NLN simulation framework is based upon. The framework has six components: teacher, student, education practices, design characteristics, simulation experience and outcomes. From this model the authors looked at the areas of objectives, planning, complexity, cues and debriefing for their simulation scenarios. These scales were used to assess 194 UGNS, who completed a scenario on comorbid mental and physical illnesses in older adults. They found that participating in the simulation led to increased student confidence and diagnosing ability.

Riley-Baker et al. (2020) evaluated the use of an evolving case study of a pregnant veteran with post-traumatic stress disorder developed by the NLN, which followed the standards of best practice established by the International Nursing Association for Clinical Simulation and Learning. They observed and assessed 253 UGNS in the scenario, who also reflected and reported on the scenario. The students gathered several skills from participating in the scenario, but reflected on it being difficult.

Speeney et al. (2018) also used Jeffries’ simulation framework to develop their SP learning experience. They undertook a quasi-experimental study with 54 American UGNS, which implemented a scenario focused on schizophrenia. The researchers reported that undergraduate nurses will seldom treat patients diagnosed with schizophrenia on clinical rotations, but, because of comorbidities, they may often treat them for other conditions and, thus, a clinical scenario is useful (Speeney et al., 2018).

Ozkara San et al. (2021) used SPs as per the Association Standardised Patient Educators’ (ASPE) guidelines to portray two MH scenarios. This meant SPs were familiarised with the case, learned to use the evaluation checklist, and were rehearsed. Educators verified scenario authenticity in actual practice. This study was undertaken with UGNS in the USA (76) and Turkey (96). The white participants in the USA reported being less self-confident than other ethnicities, while previous MH scenario experience appeared to influence responses.



Donovan and Mullen's (2019) study looked further at an implementation plan for SPs and developed a three-pronged approach to SP development that included recruitment, orientation and retention to establish a pool of SP candidates. This assisted in the development of objectives, purpose, roles, responsibilities and expectations, and retention of SPs. Such an approach was stated as a practical matrix for implementing an SP programme in the context of the International Nursing Association Clinical Simulation and Learning Standards of Best Practice – Simulation. The study was undertaken with 160 UGNS across three courses, with results highlighting how the scenario increased confidence.

Moreover, Kable et al. (2018) evaluated a range of simulation sessions using SP, medium to high fidelity, using an observational scale developed for evidence-based quality indicators. The quality indicators were previously developed by the authors – pedagogical principles, student preparation and orientation, fidelity and debriefing were examined. They held 17 simulations with 143 students across the UK as well as Australia, and evaluated the different simulations against their objectives.

These best-practice standards and models assist in the development of an effective simulation, as a simulation needs to be appropriately instructionally designed and well executed to provide the effective cognitive, psychomotor and affective learning experiences (Jeffries, 2007; Rothgeb, 2008; van Merriënboer & Sweller, 2005). These experiences enable the student to transfer and apply their knowledge to clinical practice. The use of INASCL standards and a specific model, such as the NLN framework, will help with simulation design. If using an SP, ASPE guidelines are useful in training staff and the actor to ensure an authentic learning experience.

## Evaluation of simulation experience

Evaluation of the simulation experience is a necessary to assess efficacy of scenarios. In this review, studies commonly used student satisfaction and self-confidence in learning, competency scales, and a variety of t-tests looking at specific knowledge acquisition pre- and post-simulation. Speeney et al. (2018) utilised a ten-item visual analogue scale (VAS), which looked at a perceived level of confidence in nursing care with a patient with schizophrenia. Following a one-hour lecture on nursing care with a patient diagnosed with schizophrenia, students completed a ten-item knowledge test. These were completed before and after the lecture and simulation.

Witt et al. (2018) used a ten-item multiple-choice National Council Licensure exam pre- and post-test developed for each simulation. The test looked at the MH conditions portrayed in the scenarios. Donovan and Mullen (2019) included a pre-test survey that examined student demographics and confidence in caring for an SP. The post-test simulation survey explored students' rating of their care of the SP, satisfaction in their learning experience and how the simulation prepared them for their upcoming clinical learning experience.

Thompson Martin and Chanda (2016) incorporated a VAS for students to rate their level of confidence with their therapeutic communication skills, and a ten-item pre- and post-test exploring their application of therapeutic and non-therapeutic communication techniques. They reported a significant increase in confidence and communication in UGNS post-scenario. Goh et al. (2016) included the NLN student satisfaction and self-confidence in learning scale, which enabled them to look at student's satisfaction and confidence post an SP simulation. Goh et. al (2016) conducted their research with 95 Singapore UGNS and found an SP MH scenario allowed students an opportunity to practice their communication skills and improve confidence levels.

Dunn and Riley-Doucet (2017) used the MH nursing clinical confidence scale, a previously tested tool, and the medical/surgical nursing clinical confidence scale before and after simulations. The MH nursing clinical confidence scale is a 20-item scale that covers six domains: assessment, communication, education, medication knowledge, self-management and teamwork. The tool was adjusted to meet the objectives of the scenarios and was adapted to create the medical/surgical clinical confidence scale. They found significant increases in self-confidence of UGNS post-simulation.

## Literature and scoping reviews

There were also four literature or scoping reviews included. For instance, in a scoping review of eight papers (that met the inclusion criteria) that focused on ethics in MH education, Sedgwick et al. (2020) reported that the lack of a clear definition of ethics meant that student learning was hampered. They also noted that the scant literature reviewed was a limitation of their study. Hall (2017) conducted a literature review on 45 studies (that met the reviewers' criteria) reporting outcomes of MH simulations with UGNS. They maintained that MH simulations are such a valuable learning tool that they should be mandated in the UGN curriculum, yet many Australian universities do not recognise them as such. Øgård-Repål et al. (2018) conducted another review of six papers (after criteria applied) looking at the evidence supporting the efficacy of SPs with UGNS. They found that SPs could reduce UGNS' anxiety and increase self-confidence and awareness. Kunst (2018) conducted a literature review on the use of high-fidelity mannequins and the impact on UGNS confidence (nine studies met the inclusion criteria). They stated that more longitudinal studies were needed on the effectiveness of simulation.

## Positive results

Most studies reported overwhelmingly positive results using SP methodology for simulations. Use of high-fidelity mannequins was not as common in an MH scenario, and although it was always discussed favourably, the MaskEd™ technique was also not discussed with as much frequency. Alexander et al. (2018) conducted an Australian research project using two focus groups (13 participants in total) exploring UGNS' attitudes to an MH scenario focusing on delusional schizophrenia. Study results report that SPs are ideal for MH, where communication, empathy and reduction in stigma are required. Use of an MH scenario was reported as bridging the gap between theory and the practical context.

Donovan and Mullen (2019) conducted a quantitative study (pre- and post-MH scenario surveys with 160 UGNS from three consecutive years' classes during 2015–2016) in the United States. They found interaction with an SP improved psychological fidelity, with students able to interact individually with the SP, and added to their understanding of the communication process. Thompson Martin and Chanda's (2016) research conducted a pre–post survey with 28 UGNS who participated in an MH scenario focused on psychiatric disorders in the USA. Results showed that the use of SP MH simulation, combined with debriefing, enhanced students' confidence with their communication skills.

In contrast, however, Liu (2021) also conducted a quantitative study with 149 UGNS (valid responses) involved in a simulation on depression and schizophrenia and 150 (valid responses) who were not. Results showed that there was no difference between groups in terms of assessment ability and recognition of mental disorders. This is at odds with the other studies discussed here, which may be because of, as the authors suggest, the particular samples of nursing students involved in the study. There was one other study not undertaken with UGNS per se, but, instead, with a total of 231 Spanish professors and lecturers (across three rounds of data collection) who were responsible for designing standards for simulations for UGNS (Raurell-Torreda et al., 2020). They made 163 recommendations from a standardised list of Nursing Intervention Classifications that can be used as a framework for creating MH simulations for UGNS.

## Summary of results

Studies showed how students reported a deconstruction of stigma-based fear or anxiety (Alexander et al., 2018) in dealing with patients in the MH setting, that simulations improved their communication skills (Goh et al., 2016; Thompson Martin & Chanda, 2016; Witt et al., 2018), boosted self-confidence (Goh et al., 2016; Kunst et al., 2018), and the "non-threatening and safe environment" meant that the students felt free to make mistakes without fearing judgement (Goh et al., 2016, p. 171). Simulation was also reported as bridging a gap between theory and practice (Alexander et al., 2018; Raurell-Torreda et al., 2020). Yet other researchers were more circumspect. For instance, in a scoping review of eight papers (that met the reviewers' inclusion criteria) focused on ethics in MH education, Sedgwick et al. (2020) reported that the lack of a clear and consistent definition of ethics meant that student

learning was hampered. They also noted that the scant literature reviewed was a limitation of their study. Similarly, others argued that, because of small sample size, their findings should be viewed with caution (e.g., Speeney et al., 2018; Witt et al., 2018). Riley-Baker (2020) also said that a simulation should not be a one-off activity and more longitudinal data is needed to assess the efficacy of MH scenarios.

Tips for enhancing learning from MH simulations include repeating them (Riley-Baker et al., 2020), or concealing the simulation prior to engagement (Dunn & Riley-Doucet, 2017). Of interest, two studies also mentioned the financial cost of the simulation, with two stating that the benefits of the simulation (such as increasing student confidence and self-efficacy) outweighed the cost (Dunn & Riley-Doucet, 2017; Goh et al., 2016).

## Limitations of the research

Most studies reviewed were undertaken in the USA and Australia, where different health models, organisational nursing bodies and nursing curricula exist. The lack of New Zealand research highlights that the use of MH simulations in the training of undergraduate nurses in the national context is not very well understood. Half of the reviewed articles were also published in *Clinical Simulation in Nursing*, highlighting that this may be the most useful scholarly publication for those wishing to design an MH simulation based on best evidence-based research.

Commonly noted limitations of the research studies included small sample sizes, students' self-reported feelings of confidence from participating, and a lack of diversity in cohort studies. For instance, "the sample was small [and] students were recruited from one nursing program" (Witt et al., 2018, p. 19). The studies that reported that their small sample size impacted on the generalisability of findings were primarily quantitative. Given the limited studies focusing on simulations in MH nursing education, we argue that study findings are useful even when the participant sample is less than quantitatively ideal.

Most studies utilised data methods where students rated their own experience of MH scenarios, rather than quality-control or pedagogical objectives. This may be because the aim of simulations is to take theoretical knowledge and put it into practice (Al Gharibi & Arulappan, 2020). Studies exploring nursing students' confidence with simulated patients with schizophrenia, for example, may serve the nursing student cohort and nurses in general better than those reflecting on designing the scenario (see Speeney et al., 2018). Since there is diversity in nursing students and amongst populations with MH concerns, then an MH simulation that tries to cater for all students and patients alike is unlikely to be effective for all. Consequently, as Riley-Baker et al. (2020) argue, complex MH simulations need to be interspersed through the duration of a programme, and not as a simple one-off activity.

In their study into two simulated MH scenarios on two university campuses in the USA and Turkey, Ozkara San et al. (2021) reported that the white American students reported "lower perceived self-confidence when compared with other students self-identified in all other ethnicities as a result of the intervention" (p. 152). Ozkara San et al.'s (2021) was also the only study that mentioned that Jefferies' (2016) model for cultural competence and confidence was used in congruence with international guidelines on simulation for development of simulation content. This is potentially of interest, given that the Nursing Council of New Zealand (2021) has mandated that nurses must practice in a culturally safe manner. To do so, nurses must critically reflect on their cultural identity and how it impacts on their practice (Nursing Council of New Zealand, 2011).

## Study limitations

The scoping review was undertaken in a vocational education setting where some articles were unavailable, due to being published behind a paywall. Many articles were excluded because they were not written in English. Reviewing research undertaken in non-English-speaking countries may have produced different results than the studies reviewed here. It is also likely that further articles on MH simulations have been published since this scoping review was undertaken in 2021. Nevertheless, the research reviewed is a useful starting point for evaluating the strengths and drawbacks of utilising simulated MH scenarios in the undergraduate nursing curriculum.

## CONCLUSION

Although the Aotearoa New Zealand health, education and nursing sectors are likely to differ from those in the international literature reviewed here, this scoping review will be used to develop a realistic MH scenario to be used in an institutional simulation. As realistic simulations help to ease undergraduate nursing students' anxiety when working with MH patients, a simulation activity is currently being designed and will ideally be used to foster UGNS' self-confidence and clinical competency.

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# Challenged? Supporting Nursing Students with Dyslexia in Clinical Placements

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Essay



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## ABSTRACT

From my own experience as a Student Nurse Educator and my role as an Academic Liaison Nurse (ALN) in a Dedicated Education Unit (DEU), clinical practicums can be challenging for our nursing students. Responses in practicum can vary from exciting to downright scary, but for those with additional challenges such as dyslexia, getting words mixed up or incorrect spelling can have a devastating effect on their confidence and their ability to fulfil their role. This paper draws on a study completed for my Master of Applied Professional Practice about the stigma of dyslexia and the impact on nursing students. Using a framework of qualitative phenomenology, I conducted face-to-face interviews with five participants, and then employed narrative analysis to better understand their journeys. I was privileged to hear their personal stories as current nursing students and graduates talked about how they managed barriers, including fatigue, and expectations while completing their practicums. This paper shares some of the coping strategies participants offered, as well as my own reflections of how teaching and clinical staff can help. Educators and clinical leads alike need to be knowledgeable and skilled, and understanding of those with different learning styles and preferences. Consistent support and, often, repetition, are the keys to learning, and reducing stress and fatigue for those with dyslexia. In our sector, multiple programmes have work experience, placements or internships, and many of the issues and responses discussed will be transferable beyond the Bachelor of Nursing degree. I hope that sharing some of the participants' stories and my own observations may encourage others to consider how they support learners with dyslexia and discover new ideas that work.

## KEYWORDS

Nursing education, dyslexia in education, dyslexia

## INTRODUCTION

### What is dyslexia?

Dyslexia is described as a difference in the language area of the brain that influences information processing performance, and a wide range of essentially permanent difficulties associated with literacy, numeracy, phonological processing, short-term memory and hand-eye co-ordination (British Dyslexia Association, as cited in Ridley, 2011). The word 'dyslexia' originally comes from the Greek words *dys*, meaning impaired, and *lexia*, meaning word (McPheat, 2014, p. 44). There are many definitions of dyslexia found in the literature; however, these definitions are problematic because of a general lack of agreement (Price & Gale, 2006). It may be that differing definitions contribute to the stigma around dyslexia. There is a paucity of research about healthcare practitioners and dyslexia, and calls have been made for "additional research into the experiences of dyslexic nurses" (Dale & Aiken, quoted in Ridley, 2011, p. 35). Price and Gale's (2006) statement, "Dyslexia is a processing difference which is experienced by people of all ages, often characterised by difficulties in literacy" (p. 20) is typical of a fairly broad and inclusive approach. Following this approach, and given the definitional ambiguity surrounding dyslexia diagnosis, as well as recognising that many affected have an understandable reticence toward sharing learning difficulties, this paper uses the term 'dyslexia' as a broader concept, inclusive of related conditions affecting an individual's textual perception.

On a positive note, White (2007) notes that individuals with these difficulties also exhibit a 'spectrum of strengths' and being 'dyslexic' is also seen to have some positive aspects when the person is supported. This support is likely to enhance skills, as noted by Sanderson-Mann et al. (2012). These skills include heightened empathy and problem solving, an ability to think and perceive multi-dimensionally, being intuitive and insightful, and being highly aware of the environment. Such considerations are of integral importance in the clinical healthcare environment and its surroundings. However, people with dyslexia may deliberately choose to not disclose a diagnosis. This is often based on a previous negative interaction or negative staff attitudes, exacerbated when these have occurred with someone supposed to be in a supportive role (Sanderson-Mann & McCandless, 2006). This observation is supported by Hughes et al.'s (2021) study of current Aotearoa New Zealand medical working environments, where nondisclosure is often due to the significant fear of ramifications. Indeed, in many healthcare workplaces, nurses and nursing students have reported stigmatisation, and discrimination is evident in practice, from both employers and colleagues (MacDonald, 2022).

Alexander-Passe (2015) talks about the stigma of dyslexia and suggests it is an "adverse reaction to the perception of a negative evaluated difference" (p. 207). This creates an unfair perception of others, which in turn can lead to discrimination because of its invisibility. The incorrect perception is that those affected can't read or write, and they are 'stupid and unintelligent' (Alexander-Passe, 2015). Being perceived as 'stupid', or 'thick', is a common thought related to dyslexia. Evans (2015) writes of this being particularly valid in a working environment, where some may be perceived as of 'increased intelligence', such as medical staff. The stigma for those with dyslexia is that they are looked upon as if they are not up to the 'standard' required to be a registered nurse. However, those with dyslexia ask for no special treatment, so they are not viewed as different and Nielson (as cited in Pirrtimaa et al., 2015) suggests nursing students with dyslexia ask that suitable conditions to learn, and a space and time, are provided for them on a par with any other individuals in the healthcare environment.

This is not a tiny problem; the Dyslexia Foundation of New Zealand estimates one in ten New Zealanders have dyslexia. The Dyslexia Foundation notes "areas of numeracy and literacy such as numbers or letters being confused or reversed." They suggest people manage their dyslexia during childhood, but it is evident, and I have found, that particularly as they enter tertiary or higher education, the dyslexia becomes more pronounced (Dyslexia Foundation of New Zealand, n.d.). I have personally noted these literacy challenges in clinical practice.

The literature suggests that it is important for those with dyslexia that the application of classroom learning and transition into the workplace, or clinical practice environment, means finding an appropriate level to engage them in the learning, and possible successful strategies to support the specific learning difficulties (Salkeld, 2016). Developing a rapport and building trust, through informal conversations and getting to know each other, must therefore be at the forefront of the Student Nurse Educator role. Further, for some nursing students, enrolling in their nursing degree is just the beginning of the learning journey. "They may have a specific learning difficulty that has not been formally assessed and diagnosed and these individuals consequently progress into higher education and adulthood without the specific learning difficulty being formally recognised" (Salkeld, 2016, p. 47).

## Researcher positionality

As a Student Nurse Educator for the last eight years, I have found my niche in clinical education, applying teaching and learning principles to support prospective registered nurses (RNs). I feel that my own practice as an RN, alongside my higher qualifications study, has given me valuable insights into how best to offer nursing students support and guidance in patient care, acquiring nursing skills and building communication with patients/families/whānau and the other members of the healthcare team. I enjoy the privilege of working alongside nursing students who have perceptual learning difficulties, which may be broadly termed 'dyslexia'.

Dyslexia and the effect on nursing students in clinical practice was evident for me as a Student Nurse Educator, particularly when in the clinical setting. Through my own experiences, I know that the clinical setting can be one of intimidation, complication, complexity and the unknown, especially so for nursing students with dyslexia, and related conditions. Working with nursing students predominately in hospital-based acute areas, it became evident

to me that some were able to fluently apply their knowledge as expected in practice, but something changed when they came to complete the written assessments associated with the clinical practicums. This included clinical notes, verbal handovers, clinical reasoning cycles and written care plans. It was challenging and created increased anxiety levels in some, impacting on their clinical practicum; this ignited my interest in learning the 'why'. It has been my growing awareness of their challenges, and my interest in strategies that can help to mitigate the associated stress, that have provided the impetus for this study.

With this background established and my own curiosity about the topic engaged, the key research question, "What is the impact of dyslexia on nursing students in clinical practicum?" was developed. This not only guided the study described in this paper, but will be used to further develop strategies for enrichment and support for future nursing students that identify with dyslexia in the Bachelor of Nursing programme at my own institution, and hopefully further afield.

## METHODS

The aim of this research is to understand the 'phenomenon' of nursing students coping with dyslexia through capturing real-time stories and lived experiences. This is to safeguard appropriate support systems that are accessible to boost confidence, to raise self-esteem and provide a practical source of information for nursing students with dyslexia, to help them to achieve success when in their clinical practicums (Burden, 2008). At the heart of this study is a safe place for dialogue about the challenges faced in the Bachelor of Nursing programme and subsequently as a Registered Nurse. The stigma that accompanies dyslexia and the creation of misunderstanding were what I was really interested in. A personal objective was to identify ways I could improve and nurture confidence in their progress. Accordingly, this study used a qualitative approach to gather first-hand narratives from participants, in a series of individual semi-structured interviews.

Privacy and confidentiality for the participants was paramount and ethics approval was gained from the Toi Ohomai Institute of Technology Ethics Committee. Written reassurance included demonstrating privacy and confidentiality safeguards, and the four principles of informed consent; removal of identifying features or details, the notion of 'do no harm' to physical or psychological health, and allowing participant voice to be 'heard' through their own words were observed.

Acquiring participants to share their stories was time consuming. This may be due to not being aware they had dyslexia, the stigma associated with dyslexia or the hesitancy to disclose they have dyslexia. The uptake of participants for the research was very slow, and this was associated with participants with dyslexia not wanting to be identified. This was particularly true if they were a current student and conscious of the stigma associated with dyslexia of stupidity and slow learning. The concerns around not disclosing their dyslexia could therefore create barriers not only for their learning, but also their participation in the study. For example, it was brought to the author's attention that, in a first iteration, there may be 'too many words' for people to read on the information sheets provided to participants in the study. Eventually, five participants volunteered their stories for this small study.

The design and methodology used was qualitative phenomenology, and this was chosen so study participants could share their stories and give the reader their personal experiences about the impact of dyslexia when they are on clinical practicums. As Alhazmi and Kaufman (2022) note, "annotating and clarifying human experience can be a challenging task not only because of the complexity of human nature, but also because an individual's experience is a multidimensional phenomenon, that is, psychologically oriented, culturally driven, and socially structured" (para. 1). In this case, the study design encouraged each participant to share their stories, beliefs, perceptions and knowledge in a way that made sense to them. Ridley (2011) affirms that the aim when using a phenomenological enquiry is to capture an understanding of the everyday lived experiences and views. Kisely and Kendall (2011) note that using qualitative studies to improve understanding is appropriate, as is nursing students' experiences to facilitate engagement and to be able to discuss and establish suggestions for action and change. Salehi et al. (2016) support this methodology as being able to capture the uniqueness of the experiences discussed, and using

this method is appropriate for a small number of participants. Confidential and face-to-face 30-minute interviews were conducted in an agreed-upon safe space, giving participants the green light to share stories, which seemed therapeutic for them.

For this research, the face-to-face interviews required sensitivity, hence the use of a secluded space (Donalek, 2004). As the focus for the research is on the clinical practicum experience, research participants were either currently enrolled in a Bachelor of Nursing programme or had recently qualified as an RN. Irvine et al. (2013) state, “the face-to-face interaction compels more small talk, joking, and remarks in which people can more fully express their humanity” (p. 5). The interviews utilised semi-structured or organised questions (see Appendix), with further enquiry emerging from dialogue during their sharing of stories. Semi-structured questions invited the participants to share their experiences of the impact dyslexia had on them, the barriers to learning in the clinical environment, the support(s) received while on clinical practicum and the effects on self-confidence.

Once the interviews were conducted and transcribed, a narrative analysis assisted me to focus on their personal stories and identify themes and sub-themes as they emerged, which could then be coded to identify discrete experiences and observations, as well as areas of convergence and overlap. The transcripts provided individual perceptions on dyslexia and the impact of dyslexia on the student when completing clinical practicums, and although some provided explanations related to this impact, some did not. The umbrella, or overarching, theme was overt fatigue with identified sub-themes of ongoing low levels of confidence, the constant use of assistive support, persistent obstacles for progress and the expectation of time management. Alhazmi and Kaufman (2022) call this sort of approach a ‘hybrid’ methodology, combining elements of both descriptive and interpretive phenomenology. The ultimate intention is to understand the phenomenon of studying with dyslexia itself rather than just assembling a number of students’ opinions and perspectives about the experience of studying.

## FINDINGS

In their interviews, participants shared stories on the impact of dyslexia and their feelings, and gave indications of the barriers they encountered. They talked about how the support was individualised and based on their opinions, and some solutions were found. Pearce (2022) agrees on the need to put their stories into perspective; that rather than changing the way students with dyslexia are, we as educators need to change the way we do things. This echoed the comments shared in the stories and were in fact similar for each participant. I was able to recognise this validity, which was consistent with previous findings in similar research, such as MacDonald (2022), who discusses the bespoke ways in which these findings become concrete for those with dyslexia. No real hierarchy was uncovered, as these themes seemed to be interconnected, and the issues involved appear to have had the same effect on all five participants. However, the additional time and planning needed for those with dyslexia to fulfil the requirements of a clinical practicum was the overwhelming theme that came out of the interviews. All participants expressed concerns about the time required for learning, on top of the other life stressors, and the levels of fatigue became “*phenomenal*.”

I was somewhat surprised at the time learning took in the participants’ days, added to work and family commitments, making me wonder how they managed to complete the programme and get their work finished, especially when an assessment was due. Or did they?

The overarching theme of fatigue (“*Why is this so hard?*”) manifested in diverse ways, and while individuals dealt with it differently, it was evident that there were recurring catalysts, or sub-themes, including: ongoing low levels of confidence; the constant use of assistive support(s); persistent obstacles for progress; and the expectations for time management imposed by others.

### Low levels of confidence

When I looked at the issue of ongoing low levels of confidence, I found all participants’ stories highlighted this as an impediment to their progress and adding daily to their uncertainties. Participants talked of the unfamiliar, ever-

changing healthcare environment as an additional hurdle; facing change and needing to learn new frameworks and approaches was additionally stressful in a learning environment. Low self-esteem and low confidence manifested differently across the participant group; for example, some cited anxiety and nervousness, while others were inclined towards withdrawal. One student said, *“the avoidance of talking to others was part of the impact, or just finding something to do away from the area of focus,”* for example, when details needed to be spoken out loud. *“I don’t talk much to the staff, I’m struggling to connect with them, and I avoid going to a big group thing, I don’t go.”* Low confidence created responses such as, *“it is difficult gaining that confidence to ask someone, because I am scared I will get knocked back.”*

As a Student Nurse Educator, understanding the reasons for a reticence to step forward and engage during practicum was advantageous when visiting nursing students, as was being able to assure supervisors that low confidence does not necessarily indicate a safety issue for patients. Confidence can be monitored and improved, but concern around withdrawal and anxiety is personal and may impact the wellbeing of nursing students – rather than those they are charged with caring for. However, it must also be accepted that, in certain conditions, the fatigue and resultant compromised care may have sub-optimal consequences for their own safety and that of patients.

### Constant use of assistive support

Use of assistive support(s) by nursing students with dyslexia and related conditions depends on individual preference. Resources mentioned included family, friends and peers, as well as e-supports such as specialised dictation software. For some participants, it was about filling the space with positive face-to-face support; for others it was more complex, with computer-based alternatives such as YouTube, Grammarly, Dragonspeak and Google Translate. During clinical placements, they accessed these supports by cellphone for spelling, comprehension and writing. Examples of specific uses included making notes when learning a new skill, writing up a patient or student time-planner, and writing to support an assessment. These e-support tools endorsed and encouraged repetition and checking to ensure that overlooking of ideas or failing to comprehend procedures because of their levels of stress and fatigue did not happen.

Another option mentioned was the utilisation of e-books, which also supported being able to review information repeatedly, and at their own pace and method. Some commented, *“What else would I do – go and find a dictionary (laugh), I usually bring my own!”* and *“I have a friend called Siri, who spells the words for me, and Grammarly. You copy and paste your work into it, and it does the punctuation for you.”* This, however, did create a dilemma, as in most clinical areas cell phones are not to be used by any staff unless on break. For nursing students on clinical practicum, it was obviously stressful, as they had been able to use these e-supports when in class. Some of the participants were courageous enough to be able to confide in co-workers and share their anxieties, but for others, seeking help with writing was a big ask, and too far out of their comfort zone.

Doikou-Avlidou (2015) suggests several other ways for academic support to be considered, such as easy-to-understand books, alternative methods of academic assessment and better organisation of the curriculum, none of which appear to have been available to the participants interviewed in this study.

### Persistent obstacles for progress

The effect of dyslexia on participants’ practice was varied, and the ways in which they dealt with it depended on what year-level practicum they were engaged in. Despite assistive support(s), most identified various persistent obstacles to their progress. For some participants, especially in their first year, the obstacles noted above were added to the challenge of the actual realisation that they have dyslexia. Participants in later year-groups commented on inconsistency in courses and placements, negative attitudes, lack of infrastructure, and large amounts of material needing to be examined or read. Many of these were directly linked to clinical staff attitudes, assumptions and biases:

*"I wasn't allowed my phone, it would have helped, just looking up words, cause when I did it at home I couldn't remember how it was said cause I struggled to spell the word. I would go round the body part of where it was, if the word came up with the first two letters, and look into that to see if that was the word ... Some are made to be preceptors and others are not."*

Negative staff attitudes were not confined to teaching staff, either. The participants revealed a consistent perception that preceptors weren't interested in learning/teaching or working alongside them. They noted feeling "stupid" or that they were "the weird one that always doesn't understand." The preceptor roles within the clinical setting are to mentor, educate, support and provide constructive feedback for nursing students. These roles are usually for a certain duration and between an experienced employee and a novice (Rosli et al., 2022). Participants said that they had understood from class that their preceptors were there to guide, assist and support, and were expecting them to share their knowledge. Their experience was somewhat different: "because you can kinda tell the people that didn't want to be bothered by you, especially if you were connected with them and you had to go to them, but yeah ..."

## Time management

Nursing and time-management skills are learned, reinforced through practice, and realistically can take a long time to master appropriately. Participants suggested a constant expectation of time management as always being "there." Some reported that prioritising their care for patients, while keeping track of new learning and collecting evidence for assessments, at times created some uncomfortable encounters, regrettably making the clinical practicum difficult. Interestingly, one participant shared an opposite view, where they became almost obsessive-compulsive about the daily routine, to ensure no mistakes were made. "I would like, like a structured plan – shows you need this done here, you need this done here and like more like bolder you know because I find when I am reading what's expected, like you know those essays, you know when you have an essay due." While in some ways this is a great demonstration of adaptation, in that the student was implementing their own ideas for time management both in clinical placement and the classroom, it could also result in a loss of flexibility, responsiveness and initiative – all important skills in a healthcare workplace.

Flexibility is also an important element of resilience, an attribute that wraps around each of the sub-themes discussed above. Chaboyer and Wallis (cited in Stephens, 2013) describe resilience as "an ongoing process of struggling with hardship and not giving up" (p. 133). They propose it as a means of providing optimism and successful outcomes by surviving challenges and adversity throughout an individual's nursing career. While it looked as if participants in this study held some confidential information close to their chest to varying degrees, the process of struggling on alone, for example with time management, or confidence, access to supports or encountering persistent obstacles, had likely helped them to unconsciously build up a resilience. For one participant who had recently graduated, this was now seen as helpful in their work as an RN: "I have managed to persevere and get through, I think I must just be used to living like that, maybe? It is not as bad as what others go through, so I've just kind of done the Kiwi thing and toughened up and managed it. I have not really anticipated it to be really bad."

Another participant had a similar story: "It is through sheer determination I got my degree and the assignments I really struggled with, that's what the feedback said, I didn't write down enough or it wasn't right."

## DISCUSSION AND CONCLUSION

Dyslexia can affect up to 4% of the general population (Dyslexia Foundation of New Zealand, n.d.); given the number of nursing students working in healthcare, this equates to approximately 400 Bachelor of Nursing students every year who are likely to be challenged daily with dyslexia – in their studies and in their clinical practicum placements. This summarises what participants shared about their own challenges; and for some it was the first time they had an opportunity to comfortably talk about their own learning journey: "I didn't tell anyone for years, I just found ways of dealing with it and I would just hide it and figure the basic."



While there were commonalities in the effects of dyslexia on each participant, they each very much had their own story, effects and encounters. All participants viewed dyslexia as just “life” and saw the need to get on and deal with it during their tertiary studies. They had experienced confusion and difficulty during their school days at times, but accepted that school was not for them, or they devised ways to manage this. Once they came to tertiary study and the need to seek support became evident, responses varied. Depending on the individual, they either sought out, or were approached by, academic staff, but, overall, they found this disclosure came more easily in a classroom environment, rather than during a clinical work placement.

Sharing their stories is the first step in distributing understanding about dyslexia and related conditions, and encouraging our own, and our colleagues’, critical reflection about unconscious assumptions and stereotyping (Alexander-Passe, 2015). Our next step must be self-education about the raft of strategies and supports that are available and may be helpful, but always recognising that each learner is an individual, and it may take considerable trial and error before the most useful solutions for each circumstance are created. Above all, most nursing students appreciated teachers, preceptors and managers who provided encouragement and support, who were interested in their learning and progress, and who listened.

Participants were generally clear about the tools and supports they liked best: self-help websites, buddy learning, Irlen glasses, computer software, time scheduling and structure, dictionaries, and personalising notes, for example with colours.

The study has certainly yielded some valuable learning about how nursing students experience dyslexia, what they find helpful and what is not, and those with dyslexia should be encouraged to develop and use effective, albeit simple, coping strategies (Crouch, 2019). However, as with any small-scale inquiry with this type of research design, it is important to record limitations and caution against too easily assuming these participants’ experiences will be representative of that of all nursing students faced with the same learning challenges. In this case, the small number of participants, the non-identification of Māori and Pasifika and the limited institutes surveyed are noted. For this research to have more impact, and to better the support provided to nursing students with dyslexia, these limitations would need to be addressed through further explorations.

Nursing students are adult learners – with or without dyslexia – and want to be autonomous and self-directed. What they need from us, and it’s very little to ask, is that we are prepared to support their learning rather than make it more difficult. Learning about dyslexia and related conditions is a professional obligation – and a privilege.

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## APPENDIX QUESTIONS

**Research Question:** What is the impact of dyslexia on nursing students in clinical practicum?

- A. Let us focus on your 'perceptual difficulties'. Could you give me some examples in your clinical practice of how this has affected you?
- B. Has/did dyslexia affect(ed) your ability to complete your clinical practice? If so, how?
- C. Did you note any other barriers to your learning in the clinical environment? Do you have an example?
- D. Now let us talk about being a nursing student. Do/did you receive additional support for your learning challenges? What was this support you received? Do/did you think the support was particularly helpful?
- E. At any time did you feel there was anything else to provide support to you to assist you better coping in clinical practice?
- F. When you were a nursing student and given the support above, do you feel this has increased your confidence in the clinical environment?
- G. Have you noted the experience in the clinical area had any effect on your self-confidence?

# Disruption as a Way Forward: Resilience and Adaptation to Prepare Bakery Students for the Future

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Practice Paper



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## ABSTRACT

Ever since the first humans accidentally mixed grains with water to ferment dough, the bakery profession has embraced social, cultural and political disruptions to advance its understanding and practices. During the last five years, the Level 5 Bakery Programme at Toi Ohomai has employed project-based learning (PBL) pedagogies to create real-world learning environments and provide baking students with 21st-century skills. In March 2020, Covid-19 created significant disruptions to this learning environment, with the programme and its learners being forced to quickly pivot their traditional practices to ensure contemporary and pedagogically responsive learning continued. Here, I discuss anecdotal findings around PBL and the work-ready preparedness of bakery students in a post-Covid landscape, with broader implications for PBL environments and responsive pedagogy.

## KEYWORDS

Project-based learning, vocational study

## INTRODUCTION

Learning outcomes are crucial in shaping the educational content and assessment methods used in courses, as they ensure that courses remain relevant to industry requirements. In vocational subjects, hands-on assessments are commonly used to teach these outcomes, with the teaching environment simulating scenarios that closely mimic work environments. In the Level 5 Diploma in Baking at the institution at which I teach, there are two overarching learning outcomes:

- Prepare, bake, and present/sell a specialist range of baked bread products based on traditional production techniques.
- Plan for and lead a team in a bakery, complying with current legislation and safe work practices.

As a third-generation European baker-pâtissier with 36 years of experience owning businesses, leading teams, managing bakeries, working in boutique establishments, and teaching for six years, I seek to emulate the essence of the baking and pâtisserie experiences and scenarios that are central to this industry. However, the Covid-19 pandemic presented an unprecedented challenge as the campus was locked down, disrupting the teaching process. The institute had to adapt to ensure that the learning of students was not compromised, which involved teaching more theory-based content online.

When the lockdown period ended, assessments had to be conducted in a socially distanced configuration to emulate the 'new normal' under Level 2 restrictions. The following year, under Level 3 restrictions, which the government described as 'Restrict' in their Covid response system (New Zealand Government, 2022) the teaching team had to be creative and responsive, given that the pandemic was expected to remain a challenge in the future. This paper provides an overview of how these challenges were met under the different levels of lockdown. Many businesses and bakers had to learn to adapt quickly to changes in supplies, numbers, deliveries and people power, as well as compliance, adaptation, community support and mutual aid due to the pandemic.

## BACKGROUND

The evolution of baking has been marked by disruption, beginning with the accidental discovery of fermented dough through the mixing of grains and water by humans (Baking Industry Research Trust, 2021). Through these disruptions, bakers have continuously adapted their practices to navigate new challenges and arrive at a new place of practice. Drawing on the histories and traditions of baking, I have personally witnessed these disruptions and heard the stories passed down by three generations of bakers in the family. One notable disruption occurred during World War Two, when my grandfather and his peers risked their lives to source flour on the black market and bake bread for the Belgian Resistance after their bakery was bombed, resulting in the setting up of makeshift and 'underground' bakeries. These stories demonstrate resilience, hard work, adaptation and problem solving in response to various scenarios beyond their control, leading to the baking of different kinds of bread and other products.

Another significant disruption was the era of general stores and supermarkets. While less dramatic, this disruption had a troubling impact on the livelihoods of numerous bakers (Blythman, 2004). I witnessed this first-hand as the son and grandson of bakery owners. This period marked a pivotal moment in the evolution of the industry, as it brought about a new wave of consumer convenience and choice, with the availability of pre-packaged and processed goods, including baked goods. This shift away from traditional methods and locally sourced ingredients presented a formidable challenge for bakers, who were compelled to adapt to the changing demands of the market to remain competitive. As such, the rise of general stores and supermarkets had far-reaching implications for both bakers and consumers, underscoring the ongoing evolution and transformation of the baking industry over time. Once again, bakers were forced to reinvent themselves in various ways to counter these challenges and ensure their survival.

The Covid-19 pandemic brought new challenges through disrupting the practice-based learning (PBL) (Thomas, 2000) landscape of our bakery students, as well as its impacts on the wider industry. The quote "LIFE IS PAIN au chocolate" (INDEPEST, 2021) resonates with me on many levels. It suggests a humorous way of looking at life's challenges by adding the phrase 'life is' to the name of a classic French pastry, the pain au chocolat. The intricate layers of the pastry require effort, much like adapting to difficult situations in life. This interpretation emphasises the importance of finding joy and humour in tough times, and reminds us that life is not always easy, and adaptation is a very important tool.

## IMPLEMENTING THE NEW LEARNING ENVIRONMENT

The bakery industry already faces significant staffing shortages, and adapting to the pandemic has presented additional difficulties. However, by introducing innovative training methods, we can demonstrate that resilience comes in many forms, and problem-solving is one of them. Adaptation and creative thinking are also forms of resilience, and witnessing first-hand how to make the most out of difficult situations can be highly beneficial to students in training. Moreover, being able to work with technology beyond the realm of baking, such as generating order sheets and delegating packing and delivery under unique circumstances, is a valuable skill that students can develop and they had the opportunity to experience a good example of PBL in the 21st-century teaching model (Stauffer, 2022).

As educators, we were faced with a situation that required problem-solving skills not related to the wrong ingredient in a recipe, but, rather, how to handle the unexpected challenges that arose due to the Covid-19 pandemic. Specifically, we had to determine how to proceed with Level 5 Diploma in Baking assessments while incorporating in-person, practical assessments and ensuring that our PBL students were not compromised.

The Level 5 Diploma in Baking required 20 students to plan, lead, and operate a bakery shop on campus, with on-campus staff and students serving as consumers. Under Level 2 restrictions, social distancing measures were implemented, including one entry and one exit point for the sales counter. However, during Level 3 restrictions, social distancing was no longer an option. To address this challenge, we considered the 'click and collect' model,

which is a form of contactless selling where businesses receive online or telephone orders, prepare them at a specific time, and have customers pick them up at a designated spot. This model was inspired by supermarkets, which were already running a similar model before the pandemic. We decided to implement this model with our students as a real-life learning experience that would prepare them for the world they would graduate into (Chan, 2011).

We announced on the school platform (an online service where students and staff can follow what is happening on campus grounds) that the students would still operate the shop, but in a click-and-collect configuration. Students were responsible for preparing orders, arranging pick-up times, handling safety measures, managing their appointed staff, and managing food orders and production. The students were required to record the events during the assessment and provide an e-portfolio with photo evidence of how they resolved problems and managed other situations.

To evaluate the effectiveness of this new assessment approach, I observed and recorded the events in the classroom during the teaching and learning experience, by keeping notes and taking photographs. The results of this evaluation, including how our students responded to the reinterpretation in assessment, working conditions and supply chain, are discussed in detail below.

## RESULTS AND OBSERVATIONS

During our collaboration with the students, we observed and documented their problem-solving abilities, individual resilience and teamwork, which shone through even in challenging situations. All the students had positive reactions to the changes, as these allowed them to submit their assessments within the designated timeframe, eliminating the need for deadline extensions. By analysing and recording the events that took place throughout the project, we were able to gain insight into the students' responses to the modified assessment, working conditions and supply chain.

We saw numerous examples demonstrated in the new teaching initiative, such as students communicating very well, and delegating and working as a team as they had to:

- Take the orders.
- Calculate the recipes for the expected yields.
- Work with no waste, as they had the exact yields given.
- Delegate the packaging and labelling, and make sure orders were ready on time, as customers had given pick-up times.

Having the students being able to witness these situations first hand while still being in training was beneficial in showing them how important it is to be adaptive, creative, problem solving and resilient. I received feedback in the form of emails from students, after the assessment, acknowledging that this had given them the opportunity to finish the assessment in the required time, which would not have been possible without the click-and-collect system. Two notable emails are quoted below:

Student 1:

*"I am writing to inform you about how utilising the click-and-collect method has facilitated the completion of my management assessment. Due to the Covid-19 lockdown, my focus on completing the assessment had dwindled, and I was struggling to complete it while simultaneously adjusting to the requirements of the next term.*

*The click-and-collect method not only allowed for the efficient filling of orders but also enabled us to work collaboratively to ensure the accuracy of each order. Furthermore, this process helped to reduce the wastage of unsold products by providing an avenue to continue selling our finished products. As time progressed, our group's ability to fulfil orders has improved significantly, and we have become more adept at working efficiently."*

Student 2:

*"I am writing to express my belief that implementing a click-and-collect system would be a highly effective means of conducting daily operations not only for Level 5, but also for other departments and levels within the kitchen.*

*There are several compelling reasons why I hold this belief, which I would like to outline below. Firstly, the ordering process is simplified and streamlined through the use of a click-and-collect system, resulting in increased efficiency and productivity. Additionally, health and safety standards can be more easily upheld, as there is no need to set up tables or other equipment that may pose a risk. Furthermore, this approach enables customers to order larger quantities, while maintaining appropriate physical distance during the ongoing Covid-19 pandemic.*

*Finally, utilising a click-and-collect system ensures that customer orders are prepared and packaged with utmost care, in accordance with health and safety protocols. I believe that this would lead to increased customer satisfaction and loyalty, while also facilitating smoother and more effective day- to-day operations within the kitchen."*

As a tutor, the ability to train students in technology proficiency is regarded as a favourable opportunity. This is particularly relevant in situations where the technology can be utilised in tasks outside of the culinary domain, such as the creation of order sheets and the delegation of packaging and delivery responsibilities in specialised conditions. Such training can enable students to develop skills that are applicable in a diverse range of contexts and enhance their overall employability. For example, receiving online orders, having to collaborate on setting up a workplan, sending food orders through the technician, and all that from home in a lockdown situation without being in the same room to communicate. These are transferable skills that can be used in many industries as well as in a teaching environment, combining homework with practical situations, without any physical contact.

## THE CHANGE IN PROCEDURE – DISCUSSION AND CONCLUSION

Disrupting habitual teaching practices had surprising results. Embracing a change in our usual teaching procedures was successful, and the adaptations from our usual teaching model ensured we prepared bakery graduates with relevant skills even in a pandemic landscape. Baking is already facing a large shortage of staffing and, having to deal with these extra measures, the industry is struggling. Training people with innovative alternatives shows them that being resilient does not only mean being tough, but that resilience also comes in other forms, and that problem solving is in its own way a resilient thing to do (Hayes, 2020).

The importance of the "4Cs" in 21st-century learning (Levin-Goldberg, 2021) are perfectly aligned with the baking industry, as well as being essential for modern learning environments. These 4Cs are:

- Critical thinking
- Creativity
- Communication
- Collaboration

These were demonstrated during the adapted assessment in the following ways.

- **Critical thinking:** How are we going to set up our bakery space inside the campus to be able to do contactless serving? (It was up to the students to work that out.)
- **Creativity:** Select the packaging compatible for small and big orders, how to advertise it on the institute platform, how to register the orders.
- **Communication:** Get the food orders to the technician for ingredients, delegate the jobs between each other.
- **Collaboration:** Pack everything when products are made and cooled, have it all in named bags and boxes, ready at the exact pick-up time.



To conclude, I can say without doubt that the arrival of Covid-19 inadvertently provided a great opportunity for implementing new initiatives into the Level 5 Bakery classes. Embracing the impacts of a fluid and ever-changing 'obstacle' – the pandemic – and responding to and overcoming those challenges provided real-life scenarios as impactful as those responded to by bakers throughout history. The modern iterations of learning in the form of the 4Cs model, paired with resilience and problem solving, are the perfect combination to set our students apart when applying for jobs and starting their baking careers (Bente Elkjaer, 2006). The hard and soft skills they were taught in response to the lockdowns we found ourselves negotiating, and that the students embraced and excelled at, are also very transferable skills that will stand them in good stead no matter what path they choose to follow in life.

The present discourse is aptly summarised by the sagacious words of John Dewey. As a prominent philosopher and educational reformer, Dewey's insights continue to resonate in contemporary scholarship. His notable aphorism encapsulates the essence of the preceding exposition, and serves as a fitting coda to the ideas discussed herein: "The interaction of knowledge and skills with experience is key to learning" (Dewey, quoted in Sengupta & Blessinger, 2022).

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# School-Based Learning in Initial Teacher Education: An Authentic Partnership

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## Practice Paper



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## ABSTRACT

While practicum experiences are a part of most initial teacher education programmes, Open Polytechnic | Te Pūkenga recognises successful entry into the profession lies in authentic partnerships between the initial teacher education provider and schools. Our programmes enable partner schools to contribute to the delivery of initial teacher education through school-based learning experiences, while enabling pre-service teachers to contribute to their school community. This partnership model is responsive to a strong sector drive to ensure beginning teachers enter the profession 'work-ready' with extensive practical experience alongside theoretical knowledge, and offers benefits to pre-service teachers and schools. This practice paper describes an authentic partner-driven co-construction of the development and delivery of a fundamental element of the new programmes. School-based learning experiences provide opportunities to observe and critique theoretical knowledge in authentic and situated practice.

## KEYWORDS

Initial teacher education, practicum, teacher training, school-based learning

## BACKGROUND – WHAT IS SCHOOL-BASED LEARNING?

Mā te pā te kaiako e whakatipu  
It takes a village to raise a teacher

Recently, Open Polytechnic Te Kuratini Tuwhera o Aotearoa | Te Pūkenga launched a suite of initial teacher education (ITE) programmes for the primary and secondary sectors. Alongside the online course work and practicum experiences runs a school-based learning component, which is fundamental to Open Polytechnic's programmes.

A condition of enrolment into Open Polytechnic's ITE programmes is that partner schools are confirmed for potential students. This requires liaison between the student, the partner school and Open Polytechnic. A representative from the partner school may join Open Polytechnic academics on the enrolment interview panel and participate in the enrolment decision-making. After acceptance, school-based learning begins from as early as the first week of the programme.

The school-based learning is an important, formative component of the programme, which sees full-time pre-service teachers complete two days a week in a partner school throughout their programme. For students in the Bachelor of Teaching programme, this means 140 days of school-based learning, in addition to 120 days of practicum. For students in the Graduate Diploma programmes, this means 40 days of school-based learning, in addition to 80 days of practicum. This offers pre-service teachers opportunities to participate in collaborative learning experiences, become part of a local community, and actively learn alongside qualified teachers. School-based learning differs from practicum in that pre-service teachers can move across the school, observing and interacting with teachers and students in different year levels and curriculum areas. It allows them to be immersed in a professional context and experience the realities of life in schools, and provides a valuable opportunity for teachers in schools to contribute to the richness of learning and inducting pre-service teachers into the teaching profession.

There were three key reasons for including a school-based learning element in these programmes – clear benefits for pre-service teachers, benefits to schools, and an appeal from the school sector to collaborate in the development of new teachers.

## **BENEFITS FOR PRE-SERVICE TEACHERS**

Firstly, it is widely reported in the literature that time spent in schools is the most valuable and influential part of teacher preparation and plays a critical role in the learning-to-teach process of pre-service teachers (Allen, 2009; Busher et al., 2015; Hartsuyker, 2007; Hodges et al., 2017; Palacios Mena & Reedy, 2022; Petrarca & Van Nuland, 2020; Trent, 2013). Indeed, Levine (2006) asserts that high-quality practical experiences that are sustained, begin early, and provide immediate application and connection of theory to real classroom situations are an essential factor in exemplary teacher education programmes.

In addition, there is evidence that having field-based experiences in a host school can be a powerful force in terms of pre-service teachers gaining a sense of “belonging” and “being” – both of which are needed for their development (Dewhurst et al., 2020; Ussher, 2010; Whatman & MacDonald, 2017). These placements need to be long enough for genuine relationships to develop and be maintained (Whatman & MacDonald, 2017). A sense of belonging arguably underpins and supports the connections that pre-service teachers have to their schools and colleagues while on placement (Johnston, 2010; Ussher, 2010), and community acceptance and a sense of belongingness builds confidence and agency (Jones et al., 2014).

These findings commonly relate to practicum or micro-teaching experiences. Where a school-based learning-type programme has been used, results have been similarly positive. The trial of the Collaborative University School Partnership (CUSP) programme developed at the University of Waikato that placed first-year primary pre-service teachers in a classroom for one day a week over two semesters found that they felt better prepared for the practicum (Harlow et al., 2014). The pre-service teachers in the programme reported feeling confident about building relationships with children (98%), reflecting about how children learn (97%), and making connections between theory and practice (95%). They also reported developing a good understanding of what it means to be a teacher (94%) and being ready to take on a teaching role (89%) (Harlow et al., 2014). Similar school-based learning experiences are included in some other teacher education programmes in Aotearoa New Zealand. However, Open Polytechnic’s programmes are the only ones that offer school-based learning for all students throughout their programmes, in both the primary and secondary sectors, and nationwide.

## **BENEFITS FOR SCHOOLS**

The sector consultation process revealed that many schools wished to support existing staff, currently employed as teacher aides, sports coaches, or technology teachers employed on Limited Authority to Teach contracts into the profession. These prospective students enter pre-service training with relationships and contribution in schools already established and highly valued. The partnership model provides an entry point to formal professional qualifications previously unattainable for these staff members. These programmes, which allow students to stay in their schools while training, is of significant benefit to the schools. The pre-service teachers can continue to contribute to the school, becoming increasingly more knowledgeable and skilled. As the pre-service teacher has mentor support throughout the training, it means much less mentor training is required in the first year of teaching, and schools have the support of Open Polytechnic throughout the training year. This support comes in the form of a Partnership Co-ordinator, a position created especially for these programmes, based on input from the consultation partners that they needed a dedicated contact person, and in the form of funding that can be used either for release time or paid directly to the mentor in acknowledgement of their time. Upon the students’ graduation, schools in this situation have immediately available graduates who are already known to the staff, students, whānau, and school community, and who are already familiar with school policies and procedures, the localised curriculum, and more.

## PARTNERSHIP

The third reason for including school-based learning in these programmes comes from the ongoing desire for the sector to work in collaboration with higher education institutions in the delivery of ITE in Aotearoa New Zealand. Similarly, Open Polytechnic recognised that a key to success is “genuine/authentic partnership between institutions (the tertiary institution and the school)” (Whatman & MacDonald, 2017, p. 4), and, indeed, there is a growing emphasis internationally on the need for effective and systemic university–school partnerships in order to best prepare pre-service teachers for the profession (Allen, 2011; Darling-Hammond, 2006; Jensen & Reichl, 2011; Patrick et al., 2008).

Specific feedback from school partners during Open Polytechnic’s consultation process requested that pre-service teachers be placed in a ‘home school’ for two days a week and be a part of the school’s Professional Learning and Development programme. Feedback determined that the in-situ model would allow pre-service teachers to develop relationships with school staff and experience the full range of activities that take place in a school. Again, this is supported by literature that purports high-quality ITE programmes are those that can develop and maintain “a close connection between the teacher education programme and the schools in which the teachers teach, including ongoing collaboration between academic and clinical faculties” (Levine, 2006, p. 81). Furthermore, coherence, integration and balance between ITE course work and extended field experiences, and shared professional values and ideas about quality teaching and learning, are essential components of exemplary teacher education programmes (Darling-Hammond, 2006; Le Cornu & Ewing 2008; Levine, 2006).

The partnership component of Open Polytechnic’s ITE programme aims to bring practitioner experience and academic knowledge together for the benefit of the pre-service teachers and the schools and communities they serve. An authentic, non-hierarchical partnership between academics and schoolteachers will create a transformative space for learning opportunities that will better prepare pre-service teachers to be successful (Gutiérrez, 2008; Yeigh & Lynch, 2017; Ziechner, 2010). The development of strong and ongoing partnerships will enable schools to contribute to both the development and delivery of these programmes, and, through the partners’ expertise, we can customise learning contexts and address the needs of both pre-service teachers and the schools who will employ them.

Figure 1 highlights the interrelationships between the partners that support pre-service teachers’ learning. Pre-service teachers (ākonga) are placed in the centre of our model. They are supported, in partnership, by expert staff in Open Polytechnic, and in partner and practicum schools.

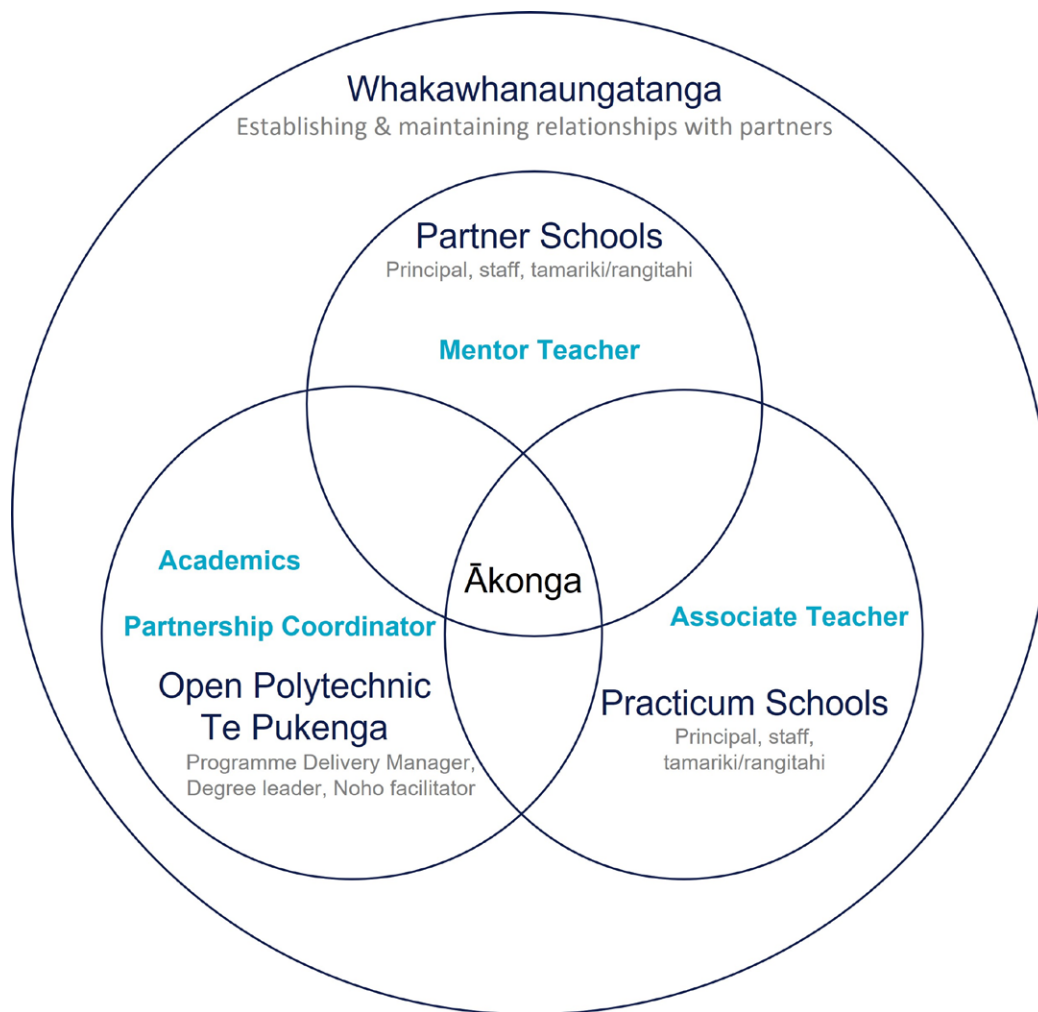


Figure 1. Open Polytechnic's ITE Partnership diagram.

## MENTOR TEACHERS

The Mentor Teacher is selected from within the partner school by the partner school principal, or nominee, in consultation with Open Polytechnic's Schools Partnership Co-ordinator. He or she is the manager of school-based learning on behalf of the school and principal. They are the 'face of teaching' for pre-service teachers in the school – someone who will support and guide, interpret experiences, and mentor. An appointed Mentor Teacher is an expert practitioner and proactive teacher who will establish strong rapport with a pre-service teacher and become a critical friend. The success of this relationship is the key to a pre-service teacher's achievement (Lawson et al., 2015; Jones et al., 2014). Ambrosetti and Dekkers (2010) contend that, while mentor roles are complex and multifaceted, mentors and pre-service teachers agree that support and constructive feedback are crucial to the mentoring experiences.

Unlike most practicum experiences, pre-service teachers do not 'shadow' their mentor. Instead, the Mentor Teacher, in consultation with the pre-service teacher, arranges learning experiences across the school, facilitates discussion, and manages learning issues as they arise. Alongside the Mentor Teacher, others in the partner school take on coaching roles for pre-service teachers. These include the senior management team, and other teachers and school staff.



## SCHOOL-BASED LEARNING TASKS

To provide some structure to the school-based learning, a range of tasks has been designed that strongly connects to the coursework of the programmes. The tasks are designed to develop incrementally over three phases: Collecting and Talking; Observing and Recording; Teaching and Reflecting.

In the first phase, Collecting and Talking, pre-service teachers are encouraged to learn about their partner school through viewing and discussing the school's localised curriculum, policies, and examples of planning. During the second phase, Observing and Recording, pre-service teachers work alongside teachers in learning contexts and professional discussions, observing and recording how learning is facilitated, how decisions for learning are made, and how relationships and learning environments are developed and maintained. Finally, during the Teaching and Reflecting phase, pre-service teachers have opportunities to work more closely with students, under the supervision and with the support of a classroom teacher.

School-based learning tasks are wide ranging, formal yet flexible, and responsive to the developing needs of pre-service teachers, partner schools, and the programme. They direct pre-service teachers to seek examples of theory enacted in practice, and to critically examine their own responses to teaching and learning experiences. Pre-service teachers are expected to participate in meetings, staff-room activities, professional development, and learning discussions. They are also expected to contribute to their partner school in ways that enable them to demonstrate their own particular skills or passions. This could be in areas such as performing arts, sports, languages and culture, literature, etc.

Authentic experience in the school is paramount. Complementing school-based learning tasks, Mentor Teachers can organise alternative or additional learning experiences within the school. This could include participating in specific learning events and observations related to the special character of the school, undertaking research and planning, and participating in the general life of the school.

## LEARNINGS FROM INITIAL IMPLEMENTATION

Open Polytechnic's initial teacher education model delivers a new approach to developing teachers for Aotearoa, and we acknowledge that it will take some time before it is fully understood by schools and prospective students. Partnerships rely on equal commitment and understanding from both parties, and we have faced some challenges in securing partner and practicum schools for potential students because of the challenges of introducing a new and different model. Many schools are still recovering post-Covid-19 and have reported that, while they may like to be involved in the future, they do not currently have the capacity. Some secondary schools have indicated that they do not have the right subject specialist to undertake mentoring for a particular student, potentially signifying a lack of understanding of the Mentor Teacher role, which highlights the importance of clear communication and easily accessible information. There is a need to further socialise the programmes, particularly the school-based learning element, in various education publications, at principals' and association conferences, through inviting potential partners to information webinars, and through inviting registrations of interest.

Despite some early lack of understanding, where pre-service teachers already had an established relationship with a school, as a teacher aide, coach, or through a Limited Authority to Teach contract, the implementation of school-based learning has gone smoothly. We have also received feedback that this model particularly suits rural and semi-rural schools, and urban schools who do not have existing agreements with other teacher education providers.

## CONCLUSION

An authentic partnership that supports effective school-based learning is an integral element of Open Polytechnic's ITE programmes. Authentic partnerships enable the school sector to actively participate in the development of new teachers, and actively empower pre-service teachers through access to a wealth of expertise across the

school. Through this partnership pre-service teachers are exposed to a range of experiences and can contribute to the ongoing culture and community of their partner school, providing invaluable benefits to their professional development. Given the long-term nature of the partnership, the benefits to pre-service teachers, schools, and their communities are far-reaching, enduring and mutually satisfying.

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# Mental Health and Hauora in Education and Policy: An Opening Discourse

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Essay



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## ABSTRACT

The current national school curriculum addresses hauora in the Health and Physical Education Curriculum; however, a review and analysis of the literature shows a lack of sustainable initiatives to support students who have experienced extreme emotional trauma, especially during the global pandemic. This article presents a critique of He Ara Oranga as the primary government inquiry document into mental health and shares the challenges that students face around mental health within the educational context. The effects of grief and loss are covered broadly in mental health and hauora, and discussed within the education context. The article highlights the inequity in the Mental Health Act to help the implementation and practice of support systems such as counselling at grassroots level, specifically in the education context. The effects of policy transcend schools and tertiary institutions; therefore, the author urges educators and scholars alike to persistently adapt and endeavour to reframe the complexities of mental health and hauora in educational settings. The article is an open discourse that argues that policies should strongly embrace future research to maintain systematic and sustainable approaches to support localised solutions.

## KEYWORDS

Mental health, hauora, national school curriculum, He Ara Oranga

## INTRODUCTION

The World Health Organization (WHO) defines mental health as “a state of wellbeing in which every individual realises his or her own potential, can cope with the normal stresses of life, can work productively and contribute to her or his community” (World Health Organization, 2022, para. 1). In the Aotearoa New Zealand educational context, students learn about mental and emotional wellbeing as an integral component to gain a comprehensive understanding of health and wellbeing. This comprehensive understanding is encapsulated in the concept of hauora, and its exploration is facilitated through Durie’s Te Whare Tapa Whā’ model (Government Inquiry into Mental Health and Addiction, 2018).

According to the Teaching Standards 3 and 4, a teacher is focused on the learning and wellbeing of each learner, and manages the learning setting to maximise learners’ physical, social, cultural and emotional safety (Education Council New Zealand Matatū Aotearoa, 2017). Therefore, a shared responsibility lies upon educators, school staff, families and whānau to cultivate a comprehensive understanding of hauora, encompassing its constituent aspects such as grief and loss, school transitions, and the effects, as well as processes, of change and growth. This collective effort is imperative within the educational setting to foster holistic wellbeing and development among students (Fitzpatrick & Riedel, 2019). However, to develop this understanding, the researcher explores and highlights links to the mental health policies that support and prompt practices around hauora and mental health, as this is the umbrella that encompasses grief and loss.

After a review of the research literature, particularly focusing on mental health and hauora, it becomes evident that progress has been made in integrating hauora into the Health and Physical Education New Zealand Curriculum (HPE NZC). Hauora is now recognised as a fundamental concept within the New Zealand Curriculum (NZC) framework, encompassing both an overarching and foundational role. However, it is worth noting that the term ‘hauora’ itself remains a subject of debate and controversy, as highlighted by Heaton (2011), who emphasises the challenges

associated with incorporating hauora into curricula (see Figure 2). Although there is a visible presence of taha wairua (spiritual wellbeing) in hauora research throughout Aotearoa New Zealand (Heaton, 2016), there is a lack of comprehensive and effectively applied knowledge at the grassroots level within schools' frontline practice, and Fitzpatrick et al. (2018) support teaching young people about mental health.

## MENTAL HEALTH – GRIEF AND LOSS

As mental health encompasses various aspects of hauora, one being grief and loss, it is therefore important, in order to establish effective and inclusive mental health policies, to recognise the inherent connection between grief and loss, and mental wellbeing. Grief and loss are commonly observed as emotional experiences intertwined with feelings of loss and psychological distress (Fiorini & Mullen, 2006). They also have physical manifestations that impact the body, such as stress and potential psychological consequences like depression. Stress affects the entire body and its organ systems, particularly the immune system, exacerbating existing conditions or giving rise to new ones, including insomnia and loss of appetite. Intense stress can even induce changes in heart muscle cells or coronary blood vessels, resulting in a condition known as stress-induced cardiomyopathy or broken-heart syndrome (O'Connor, 2019). This condition shares similar symptoms to a heart attack, including chest pain and breathlessness. Depression, on the other hand, presents with severe hopelessness, insomnia, decreased appetite, thoughts of self-harm, persistent feelings of worthlessness, and noticeable mental and physical lethargy (Bernaras et al., 2019). Individuals suffering from depression often isolate themselves from social connections and neglect self-care (Bernaras et al., 2019). Therefore, it is essential to recognise that an understanding of grief and loss can be attained through this epistemological paradigm, and it should not be perceived as a dichotomy. As a result, the researcher suggests a forward-thinking approach to mental health policy that prioritises future research to build a robust foundation for sustainable solutions. By incorporating empirical evidence-based practice and up-to-date insights on the interplay between grief and loss, and mental health, policymakers can develop targeted interventions (Government Inquiry into Mental Health and Addiction, 2018) that address the diverse needs of young people experiencing emotional distress.

## MENTAL HEALTH – TRANSITIONS AND CHANGE

Transitions and change are key elements of mental health and the concept of hauora. Transition and change, a move or/and alternation to the status quo can be difficult and challenging at the best of times, but especially for some children and young people, as it requires them to adjust and adapt. Similarly, experiencing grief and loss can present the need for change, a transition to adapting and accepting.

Considering the probable paths in which it can manifest itself in the preceding statement, it is therefore equally important to enable and aid children's understanding around grief and loss, especially in the post-Covid wave state that the world is experiencing. As Jaber (2018) cites, "Consequently, McLaughlin (1990) urges the need to view school changes holistically, and acknowledges that schools are complex nonlinear places and that educators are professional partners in school improvement" (p. 22). Therefore, it is paramount to investigate and inquire about the understanding of grief and loss in schools, due to the nature of their complex nonlinear structures.

## MENTAL HEALTH – POLICY AND REFORMS

Regarding reforms and policies, this opening discourse focuses on the implications of *He Ara Oranga*, the report of the Government Inquiry into Mental Health and Addiction, to highlight the significant influence of policy on practices and decision making within schools. This has a direct impact on how schools address the mental health challenges faced by grieving young learners, particularly when resources are limited. *He Ara Oranga* acknowledges that the Mental Health – Compulsory Assessment and Treatment Act 1992, also known as the Mental Health Act, has not adequately adapted to the shift towards a recovery- and wellbeing-oriented approach to care, and has never undergone a comprehensive review.



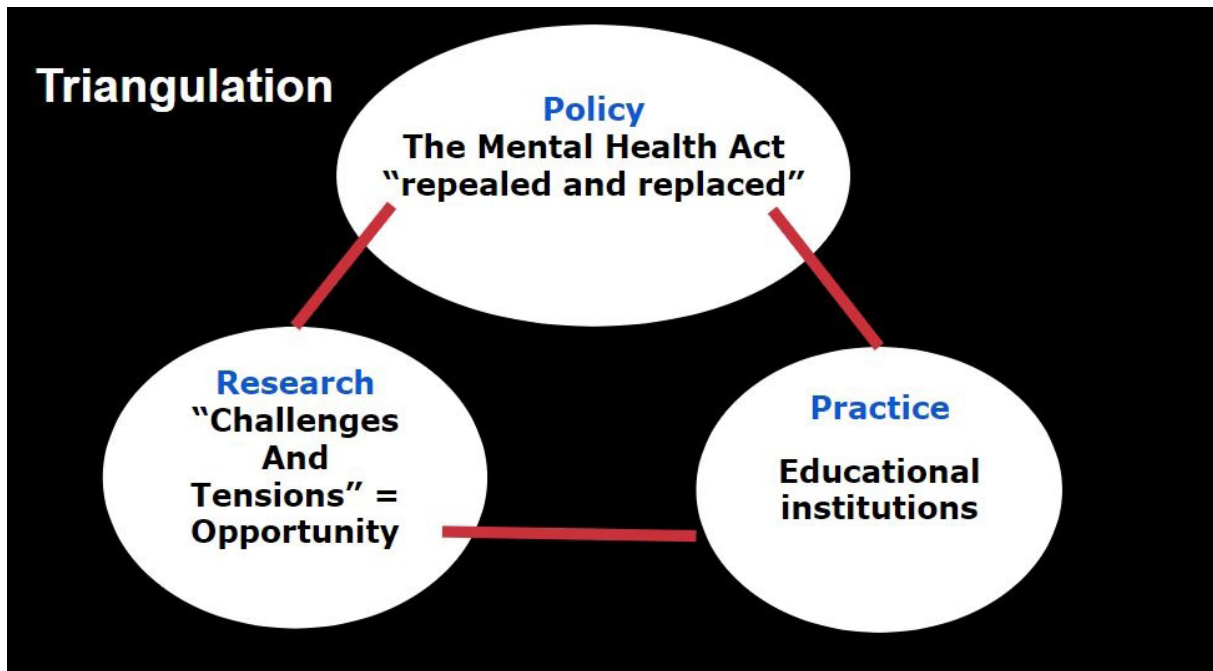


Figure 1. Triangulation and interconnectedness of research, policy and practice, highlighting this with a holistic approach and viewpoint.

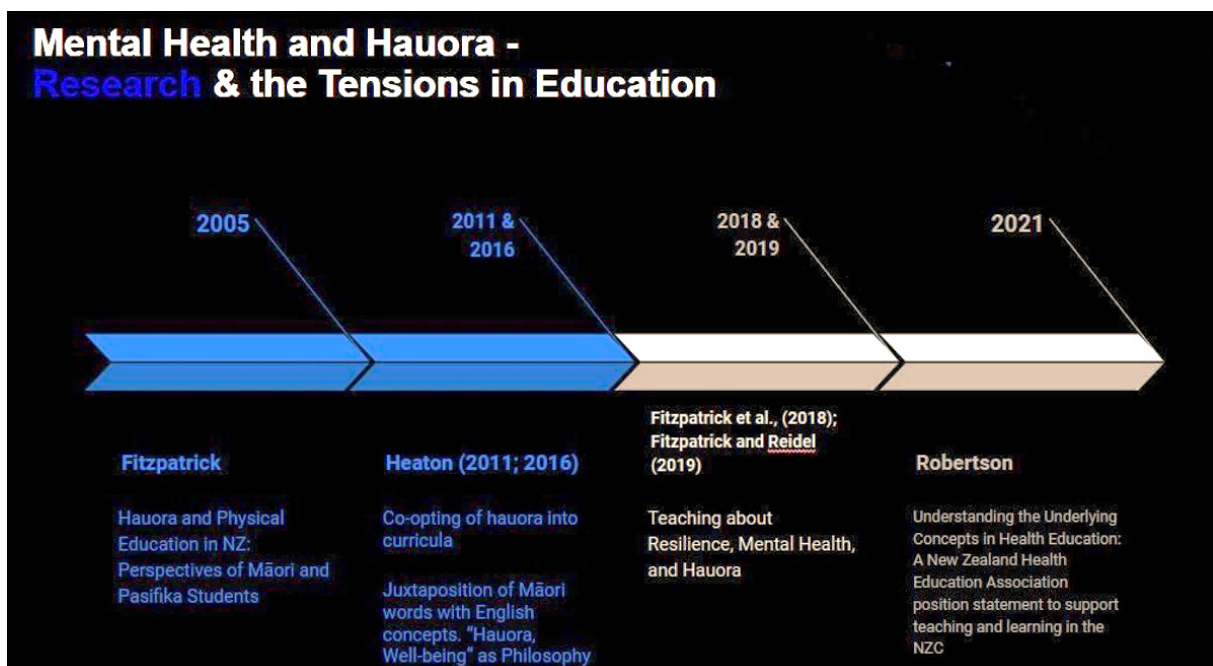


Figure 2. The dynamic concept of hauora and its integration within the educational context of New Zealand schools.

*He Ara Oranga* translates as pathways to wellness. It was published in November 2018 by the New Zealand Government as part of the inquiry into mental health and addiction (Government Inquiry into Mental Health and Addiction, 2018). Reviewing this and many other policy documents will provide a baseline to develop an understanding about the impacts of mental health reforms, intended to address the needs of all New Zealanders. The intention is to enable a unified understanding in treating the wellbeing of young learners holistically (Fitzpatrick, 2005). Drawing on the findings of such reports, it becomes possible to reach an epistemological understanding of the signs and symptoms of grief and loss, in order to help support young learners.

Over the past two decades, extensive research has been conducted on hauora as a comprehensive approach to the New Zealand Curriculum, building upon Mason Durie's original concept of hauora (Ministry of Health, 2017). Notably, prominent scholars in the field of mental health have incorporated concepts of hauora into their recent academic works focusing on mental health. However, research indicates that translating mental health and hauora research into educational practices, especially in the context of primary and intermediate schools during the global Covid-19 pandemic, has become more challenging than ever before. Future work must reflect the three-way relationship between research, policy and practice around mental health and hauora (Figure 1).

This initial examination of the literature through the work of Weare and Nind (2011), Ministry of Health (2017), Fitzpatrick et al. (2018), Fitzpatrick and Riedel (2019), and Robertson (2021) reveals an ambitious aim to integrate hauora and wellbeing. However, implementing these ideals within the context and constraints of schools proves to be more complex than merely applying rhetoric: assimilating hauora into curricula has presented significant challenges (Heaton, 2011). Figure 2 illustrates an approximate timeline of approaches to integrating hauora in the New Zealand educational context.

## MENTAL HEALTH – EDUCATION CONTEXT

In the context of education, primary schools play an important role in promoting student hauora in New Zealand, which is crucial to classroom productivity and academic performance (New Zealand Health Education Association, 2019). The New Zealand Health Education Association emphasises the importance of creating supportive school environments, implementing evidence-based classroom programmes and involving the wider communities and other stakeholders in addressing mental health issues (New Zealand Health Education Association, 2019).

Teachers hold the responsibility of fostering student wellbeing, as outlined in Our Code of Professional Responsibility and Standards for the Teaching Profession (Robertson, 2021). However, the *He Ara Oranga* report (Government Inquiry into Mental Health and Addiction, 2018) discovered that secondary school students faced significant challenges in accessing adequate support, with lengthy waiting periods to see a counsellor. Tertiary students expressed the need to work long hours to meet their financial obligations, and the lack of a supportive campus community resulted in many grappling with their mental health issues in isolation (Government Inquiry into Mental Health and Addiction, 2018). Particularly during the Covid-19 period, students across the education sector experienced overwhelming feelings of distress and helplessness, as they felt ill-equipped to cope with the challenges they faced (Jones et al., 2020).

The implementation of lockdown measures necessitated a shift from in-person learning to online, resulting in the loss of student connections and support systems. Recognising and understanding students is a crucial element of educational programmes, and is made more difficult by remote learning under lockdown conditions. Post-lockdown, re-establishing student self-efficacy and hauora (wellbeing) with students has proven to be a challenging task due to heightened stress and uncertainty exacerbating mental health issues. In the educational learning environment, whakawhanaungatanga (the establishment of interpersonal connections) and the maintenance of a comprehensive understanding of students' requirements are imperative common practices (Smart, 2021).

The Mental Health Foundation of New Zealand shared a resource for people who have experienced grief from bereavement during Covid-19, when public health protocols denied gatherings for funerals. People were concerned about keeping those who were grieving safe, while providing appropriate support and protecting them from

contracting or spreading Covid-19. This had a profound impact on students, as it was a compounding effect felt across the country. Grief, loss and mental stress due to Covid-19 saw many students at all levels of the education sector struggling due to disruption of routine, social isolation and uncertainty, with anxiety levels heightened (Mental Health Foundation of New Zealand, 2020).

Many schools turn to external providers for educational programmes to address mental health challenges and hauora. Robertson (2021) argues that the development and implementation of 'education only' programmes in schools that aim to improve health and wellbeing outcomes for young people are not effective. These sorts of programmes have existed for decades, with a persistent outcome being that most of them 'don't work' as claimed by the provider. There is a lack of convincing evidence of health/wellbeing/behavioural change. The before and after self-reporting measures typically adopted by these programmes lack rigour and show no convincing evidence of actual improved health and wellbeing outcomes sustained over time (Robertson, 2021). Consequently, there is a poor evidence base as to what works when the focus is on 'education only' programmes.

Robertson (2021) supports the use of external providers where they provide highly specialist knowledge or unique perspectives that will add value to a health education teaching and learning programme designed and planned to meet student learning needs. However, it is important that external programmes are not simply one-off events or performances that claim to have educational value, as these offer little more than 'edutainment' (Robertson, 2021) and fail to achieve change or lasting impact.

## CONCLUSION

Despite the underlying intention of government policy and systems to provide assistance, support and empowerment to individuals and to address their needs, it is evident that a significant amount of progress is yet to be made in attaining a comprehensive paradigm shift and fostering increased participation and engagement for individuals around mental health and hauora in New Zealand (Government Inquiry into Mental Health and Addiction, 2018). Additionally, an individual's wellbeing is influenced by their established identity and the level of engagement and relationships they have with educators and their peers within an educational institution. Therefore, it is crucial to foster support for wellbeing through various educational practices at both the educator level and within programme and institutional frameworks (Rainie et al., 2021).

There are compounding challenges in addressing the mental health and hauora needs within the education context due to its non-linear and complex nature. This paper intends to start a discourse triangulating policy, research and practice to bring about changes in educational policy to address the needs of young people and children within the educational paradigm around mental health and hauora. The paper contends that policies need to actively adopt prospective research within education to upraise methodical and enduring methodologies for bolstering localised solutions. It constitutes a continuous prospect for additional investigation, which is presently undertaken through a future doctoral research study by the researcher to enlighten practical implementation. Therefore, scholars and teachers alike are urged to persistently adapt and endeavour to reframe the complexities of mental health and hauora in educational settings as occasions to engage in open discussions and explore innovative solutions. For example, strengthening interdisciplinary collaboration between teachers, school counsellors, psychologists and other mental health experts to ensure a holistic approach to supporting students' mental wellbeing and hauora. Another example is to design and deliver mental health and hauora classroom units once every term as part of a deliberate act of teaching in schools, using some of the ideas suggested in Fitzpatrick et al. (2018).

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# “The Eggshell of People”: Listening to Children’s Descriptions of Dyslexia

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Essay



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## ABSTRACT

Children are often underserved because of their age, academic level, and accessibility to the processes in place to develop resources, research and policies. Being neurodivergent, or living in a neurodivergent home, can augment childhood challenges. Listening to dyslexic people, including children, offers an opportunity to respectfully visit unique dyslexic lived experiences, to explore these rich contributions, and to gain fresh insights into people's journeys. I am a dyslexic parent of a dyslexic child, and an advocate for the wider dyslexic community. I have personally found it can be challenging to articulate how dyslexia is experienced, irrespective of age, because of the difficulties dyslexic people have with expressing themselves (Lithari, 2021). This essay describes how one ten-year-old child chose to highlight dyslexia in their own words, by creating an A4 poster. Starting by looking at what is being created in the dyslexic space in Aotearoa New Zealand, the essay then discusses dyslexic lived experiences. The essay continues with a reflection on the importance of children's ideas – for example in planning projects and neighbourhood destinations – followed by comments on how the “eggshell of people” analogy might be used by educators to open up discussions about dyslexia and encourage inclusive, and safe, learning environments. It concludes with discussion points for further thought.

## KEYWORDS

Dyslexia, lived experience, positionality, children, neurodivergent

## INTRODUCTION

For many dyslexic people, interpretation using imagery is an important aspect of sense-making (Bartram, 2021). In 2020, a ten-year-old child created an A4 poster resource to explain dyslexia to the adults phasing through the child's life at that time. The resource asked the reader to “think of yourself as a chick in an egg.” Reflecting upon “the eggshell of people” was an alternative way to view dyslexic lived experiences and I could see the potential in using the analogy to explain dyslexia to other educators and learners, with the capacity for adapting it to suit different audiences and age groups. Recognising the richness and potential these windows into dyslexic sense-making possess, I developed a five-minute video. Designed to stimulate reflection, the video was presented at the ITP Research Symposium 2022 (Beckwith, 2022a), highlighting the potential available to educators, should we choose to encourage, support and listen to underserved neurodivergent learners, whānau (family) and children. Subconsciously, perhaps, some educators will be reminded of this alternative lens when they open an egg carton or see images of eggs, extending dyslexia awareness into their everyday lives. Raising awareness of dyslexia, the resources accentuate curiosity to learn and to understand, aiming to dispel myths while engendering positive mind-sets about dyslexia.

### Tīpaopao dyslexia in Aotearoa New Zealand

Dyslexia was recognised by Aotearoa New Zealand's Ministry of Education in 2007 (Tertiary Education Commission, 2021b) and is described as a “type of neurodivergence” by the Tertiary Education Commission (Tertiary Education Commission, 2022a). ‘Neurodivergent’ is an overarching term describing someone who processes information differently to others, and includes dyslexia, dyscalculia, ADHD and dysgraphia, for example. ‘Neurodivergence’



stems from 'neurodiversity', a term that emerged in 1998, referring to the differences in how people's brains function and process information (Singer, 2017).

Aotearoa New Zealand has three official languages: English, Te Reo Māori and New Zealand Sign Language. It is an island nation and has a culturally diverse population. Scattered across Aotearoa there are pools of knowledge, experience and positive support for neurodivergent communities. Often these have been created by parents, frustrated with accessibility to processes and systems for their children, or seeing an opportunity to connect with, and empower, others (Dyspraxia Support Group of New Zealand, n.d.; Summit Point, 2023; Unique Minds, 2021). Importantly, key people and organisations in Aotearoa New Zealand's dyslexic landscape are conferring and collaborating with each other and engaging with a growing network of stakeholders (Tertiary Education Commission, 2021a; 2021b; 2022b). This includes dyslexic people (Ministry of Education, 2018; Nicholson & Dymock, 2015). In 2023, these pools of light are becoming a chain of beacons, linking with others, and forming a more cohesive, connected and coherent community.

Culturally, Te Ao Māori (the Māori world view) naturally supports dyslexic people through its holistic nature, relationality and interconnectedness. Manaakitanga (showing respect, generosity and care) creates supportive and inclusive spaces for all people (Beckwith, 2022b) and is interwoven with a person's mana ("prestige, authority", Te Aka Māori Dictionary, n.d.). "The concept of mana lies at the heart of Māori self-worth and wellbeing" (Hetaraka et al., 2023, p. 3), and Dr Riwai-Couch (2021) highlights mana-enhancing descriptions for neurodiversity, which move away from the often-negative vocabulary used in the neurodiversity space. In te reo Māori, dyslexia is translated as *tīpaopao*, meaning "to do irregularly, out of sequence, out of order" (Te Aka Māori Dictionary, n.d.). In 2019, the Ministry of Education produced a te reo Māori resource to support Māori-medium settings (Ministry of Education, 2019), and in 2021 a literature review provided a view of neurodiversity from Te Ao Māori perspective (Riwai-Couch, 2021).

In a relatively short time, the dyslexia-awareness movement in Aotearoa has increasingly gained momentum and maturity (Beckwith, 2021). Dyslexia awareness has been particularly strengthened and energised since 2020, with the establishment of the Neurodiversity Community of Practice, the collaborative work of the Tertiary Education Commission's Dyslexia Work Programme Advisory Group, and the creation of the Aotearoa New Zealand Te Tohu Kounga Whakarata Tīpaopaoanga Dyslexia-Friendly Quality Mark (DFQM) (Ako Aotearoa, n.d.; Beckwith, 2021). Recommendations have been made for further research into neurodivergencies and how to support our neurodivergent learners (Riwai-Couch, 2021; Tertiary Education Commission, 2021b), and there is a growing body of research exploring dyslexic lived experiences.

## Dyslexic lived experiences and positionality

In the last couple of years, there have been many articles written about how dyslexia is experienced by dyslexic people in work, at university, at school, as young people, as trainee teachers and as adults (Jacobs et al., 2021; 2022; Lithari, 2021; Ross, 2021; Wissell et al., 2022). These are valuable experiences, highlighting how individuals experience life through a dyslexic lens, but these narratives do not necessarily include all of society's stratigraphy, such as those from lower socioeconomic backgrounds (Nevill & Forsey, 2022). Discussing how people's different contexts shape outlooks in the dyslexic landscape, Nevill and Forsey (2022) utilised a social relational model of disability, considering cultural and political capital, to explore inclusion through two people's dyslexic lens. Considering different contexts highlights how positionality is an important aspect of dyslexic lived experiences.

Positionality is about who we are as individuals, how we experience the world, and how we evolve relationships with everything around us. Our world view comes from our own unique lived experiences, our gender, our cultural heritage, our politics and our status, for example (Chin et al., 2022). Sense-making, reflection and curiosity to learn and understand can be encouraged by our positionality and relationality. Awareness of positionality also allows us to question ourselves and consider how we are talking about, and listening to, others. In their reflections, Chin et al. pose a question that all of us should consider as we engage with neurodivergent communities:

Will the practice of representing and speaking for others through my research [or work] enable the empowerment of people with disabilities? (2022, p. 25)

Authentic positionality and dyslexic lived experiences offer opportunities to reflect and consider future approaches to inclusion. Having conversations about dyslexia can dispel myths, encourage responsible and respectful support, and engender positive mindsets. However, the lived experiences of dyslexia are described from the perspective of dyslexia intersecting with everyday life, rather than how the dyslexic individual pictures, or not, their own dyslexia. The next section looks at the importance of children's ideas and relevance in contouring the dyslexic landscape now, and into the future, before returning to the 'picture' of dyslexia.

## The importance of children's ideas

Children are described by the United Nations and by Aotearoa New Zealand's Children's Commissioner as being people under the age of 18 years (Office of the Children's Commissioner, 2023b; United Nations Office of the High Commissioner, 1990). In Aotearoa, children have rights connected with whakapapa (genealogy), Te Tiriti o Waitangi (The Treaty of Waitangi), the United Nations Convention on the Rights of the Child, the United Nations Declaration on the Rights of Indigenous People, and the United Nations Convention on the Rights of Persons with Disabilities (Office of the Children's Commissioner, 2023d). The Office of the Children's Commissioner advocates for children's rights, listening to children's voices across Aotearoa and valuing these contributions in strategies and policies, such as the Child and Youth Wellbeing Strategy (Office of the Children's Commissioner, 2023c).

The importance of children's ideas can be seen in research carried out in Aotearoa New Zealand. Carroll et al. (2019) and Chaudhury et al. (2019) respectively explored the value of children's lived experiences connected to planning projects and neighbourhood destinations in Tāmaki Makaurau Auckland, Aotearoa. Children are often underserved stakeholders, whose lived experiences are missing from research (Carroll et al., 2019; Chaudhury et al., 2019). However, in Aotearoa, children's voices are becoming increasingly recognised and sought out by different teams and organisations, for example Mai World (Office of the Children's Commissioner, 2023a). Children's voices have great relevance in shaping the dyslexic landscape, both now and into the future. Children are not constrained by the same bindings that come with adults' experiences, which can stifle adults' imaginations. Educators who listen to how children describe dyslexia will have opportunities to step into the dyslexic world of future adults. A greater variety of voices will build a rich depository of descriptions for further reflection, action and inspiration.

## “THE EGGSHELL OF PEOPLE”: A CHILD'S RESOURCE

Facing some challenges in discussing dyslexia with adults phasing through my child's life in 2020, I thought it would be useful to talk about this perplexity with my child. As a result, this is how a ten-year-old child, in their own words, described how they understood dyslexia:

*The eggshell of people.*

*Think of yourself as a chick in an egg.*

*As you're breaking out of your eggshell to try new things, well, this is where dyslexic people have the advantage!*

*Dyslexic people break their own eggshell before some others do because they want to try to learn and understand things.*

*Some people in the world say that being dyslexic means you are not good at reading or writing but that's not always the case.*

*Famous people like Leonardo da Vinci and the inventor of the telephone Alexander Graham Bell were dyslexic. Even Walt Disney himself was dyslexic and the list also includes George Washington, Albert Einstein and Tom Cruise!*

*Don't be afraid of asking for help. Even chicks need support to break out of their eggshell sometimes!*

This text was made into an A4 poster, with images selected by the child, to share with others and raise awareness. The A4 poster, expressing a ten-year-old child's feelings about dyslexia, inspired me to write, and record, a five-minute recording to be presented at the ITP Research Symposium 2022. The videos from the Symposium have been uploaded to YouTube, with links in the Book of Abstracts (Savage & Bodkin-Allen, 2022). I have shared the link to my video with colleagues both within Aotearoa and overseas, to promote discussion and raise awareness of dyslexia and children's voices. Additionally, the video has been uploaded to my organisation's Dyslexia Moodle to support staff development.

The five-minute presentation for the ITP Research Symposium 2022 (Beckwith, 2022a) was developed by reflecting on the analogy of "the eggshell of people." An eggshell could be described as being similar to the barrier we can place around ourselves for protection, possibly to mask our true feelings, possibly based on our prior experiences or fear of others' perceptions of dyslexia (Lithari, 2021). There is diversity in eggs, as with the dyslexic experience. Dyslexic people are often curious (Made By Dyslexia, 2021) and keen to break through their 'eggshell' and explore new things. Eggs are used all over the world, we know their shell is protective and strong on the one hand, but is easily broken on the other. It depends on how we treat the egg as to whether we have a positive result or a negative one. As with dyslexia, how we treat each other impacts on how a dyslexic person functions and engages with daily life (Lithari, 2019).

Returning to the chick breaking out of the shell, sometimes we have to carefully and sensitively remove a piece of shell out of the way of the exhausted chick so that they can have space to emerge from the egg successfully. Reflecting on this, it is our responsibility to support our learners, taking care to provide them with a positive learning environment, and being sensitive to their prior learning and life experiences (Lithari, 2019). The physical piece of shell may not exist, but the invisible barriers to learning do (Jacobs et al., 2022). By raising our awareness of dyslexia and increasing our knowledge of where to gain access to resources, we will be able to guide our learners along their learning pathway inclusively and confidently. The next section discusses how this may be possible, by focusing on a question asked during a research project in the early 2000s.

## DISCUSSION

Lived experiences can be described, narrated, or engaged with, in different forms (Department of the Prime Minister and Cabinet, 2022). As individuals, we all have ways to express our experiences – song, poetry, music, painting, drawing, talking, writing, reflection, contemplation. However, it can be difficult to articulate the phenomenon of something that is fundamental to elements of our individuality. As a dyslexic adult, I can describe how elements of dyslexia enhance or hinder my everyday life. I can regale lived experiences *ad infinitum*, to infinity, and beyond! However, if I was asked about what my dyslexia feels like, about the phenomenon of dyslexia, I would need to give this some serious consideration. For me, as a dyslexic adult with my own lived experiences, I would find it easier to select images to describe 'what dyslexia feels like' than have to find the right words in an interview, without those visual prompts.

In their research, Burden and Burdett (2007) asked the following question to 50 boys with dyslexia, between the ages of 11 and 16 years old: "If you were to imagine dyslexia as some kind of 'thing' or picture in your mind, how would you describe it?" (p. 79).

Research exploring the lived experiences of dyslexic people tends to look at the impact of dyslexia on everyday life, how it manifests or disables, the outcomes of living with a learning difference (Brunswick & Bargary, 2022; Jacobs et al., 2021). However, the question that Burden and Burdett (2007) asked the child participants stands out in the research. Although seeking metaphors from dyslexic students to make sense of dyslexia, Burden and Burdett (2007) asked a question about the phenomenon of dyslexia that could provide a wealth of information for educators, learning designers, support workers, and the mental health and wellbeing sector. Singling this question out, further research could be completed with a new generation of children to explore how they depict dyslexia as a phenomenon, through their imagination and lived experiences, 20 years on from Burden and Burdett's research.

## CONCLUSION

Utilising lived experiences, and asking questions about what dyslexia is, encourages us to view the dyslexia phenomenon through a multitude of lenses. Children's voices and ideas are important now and into the future, as their experiences and positionalities are different to those of adults.

"The eggshell of people" is one analogy from one child who wanted to describe their understanding of dyslexia, to connect with adults and help them to visualise the child's thoughts. From this description, an A4 resource was made, a presentation presented, and this essay written. It has allowed me to draw together current ideas from the dyslexia space and look back at a question that could ignite future research and reflection.

As we hear from a growing number of dyslexic voices, we will have greater opportunities to explore dyslexia through discussion, connection and awareness. Dyslexia advocacy has a sound foundation to evolve from, and in Aotearoa we are well placed to implement values-based, effective and connected holistic support for all our learners as we journey into the future.

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# Understanding the Development of Dynamic Informal Capabilities in Enhancing Project-Based Assessments and Facilitating Programme Development

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## Research Report



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## ABSTRACT

Within the tertiary education system of Aotearoa New Zealand, polytechnics are positioned as institutions with a focus on applied, experiential and employment-oriented learning. Considering the pace of change in the workplace, it is highly unlikely that educational programmes that develop and capture only formal learning outcomes can effectively prepare work-ready graduates. Capitalising on informal achievement and recognising competencies outside of the learning outcomes or the graduate outcomes is critical.

The goal of this research is to explore the transitioning of emergent spontaneous demonstrations of competencies into facilitated competencies to enhance the consistency of informal achievement across different courses and use them as a mechanism for versatile adaptation to the job-market needs. In this case, spontaneous informal achievements are defined as capabilities demonstrated by students that had not been planned for or expected in the formal programme documents, whereas the facilitated informal achievements are planned through course design, yet not recognised in the learning outcomes for the programme (hence, informal).

The data collected for the case study includes multiple data sets from ten practical student-team projects, which were implemented in two study blocks in 2020 as part of Leadership in Action, an undergraduate course in the Applied Management programme of studies at Otago Polytechnic Auckland International Campus (OPAIC). The analysis found that across all ten projects the students demonstrated a total of 36 different competencies, with 17 formal competencies, 13 informal facilitated competencies, and six informal spontaneous competencies. The research explored the key competency areas and suggested a workflow model to implement a culture of recognising informal achievements in vocational education organisations. The implementation of the workflow model is expected to increase levels of student engagement and satisfaction with project work, and allow them to develop skills and competencies that would otherwise be overlooked in their formal programme of studies.

## KEYWORDS

Project-based assessments, informal achievement, graduate employability

## INTRODUCTION

The article presents a systematic examination of informal achievement in project-based assessments. This research was initially inspired by the strategic goal of Otago Polytechnic Auckland International Campus to prepare the most employable graduates in Aotearoa New Zealand, and the need to systemically assess the informal and student-driven learning that is critical in achieving this goal. While the exploration and formalisation of the hidden curriculum has been attempted on a number of occasions in studies conducted by polytechnics, including Otago Polytechnic, there has been little systemic and evidence-based insight into informal achievements centred around students and their projects. The idea for the research was finalised when Covid-19 lockdowns enforced self-directed learning even in scenarios where this had never been intended as part of learning design.

Over a number of years, Otago Polytechnic, in co-operation with Ako Aotearoa, has been conducting research into classifying and prioritising capabilities that matter the most for employers looking to hire people into graduate-

level positions, as part of the effort to prepare Aotearoa's most employable graduates (Otago Polytechnic, 2021a; 2021b). The Capability Framework created as the result of this work ended up as a list of 26 groups of capabilities, all of which were validated by a total of 163 employers (and stakeholders in a position to employ potential graduates), 389 alumni, several associations and professional groups, and a significant number of staff and students over several phases of data collection. The framework allowed for mapping and examining of skills on the go, and was well suited for the highly volatile scenario of the pandemic, and allowed for the strategic goal of the organisation to be tracked against clearly defined criteria.

Tertiary education is difficult to define at any point in time, but the challenges of 2020 made it near impossible. Disruptions to a variety of industries are likely to see significant increase in the number of people going back into post-secondary education. This is common, and happens during any economic crisis or downturn to a certain extent. It is, however, less common for educational institutions to experience disruptions of a similar magnitude and try to find their footing on par with the people who turn towards tertiary education specifically for guidance in uncertain times. Educational institutions may struggle to fulfil this mandate of improving the employability of learners, considering the swiftness with which job requirements have been shifting over the last year and are likely to be shifting in the next few years. As learners may be removed from a formal classroom for a variety of reasons (Beard, 2020; Farnell et al., 2021; Schleicher, 2020), either intentionally or unintentionally, educators must be prepared to take full advantage of the existing knowledge on informal learning and project-based assessments, since both concepts enhance the ability of learners to be more self-directed in their studies (Chang et al., 2018; Helle et al., 2006; Maida, 2011) and take full advantage of technological and learning-design opportunities (Altay et al., 2016; Assaf, 2021; Bennett et al., 2020).

Another result of the pandemic and the digitisation of tertiary education is a much stronger focus on student-driven and experiential learning instead of traditional instruction-based studies (Assaf, 2021; Cameron et al., 2022; Gonzalez-Ramirez et al., 2021; Naar et al., 2021). The goal of educators operating in the post-Covid environment has been to create a system that can be set up in a way that the learners could create their own projects in a safe environment, supported through resources, project-delivery infrastructure, and access to the facilitator as required.

The research question that this article is attempting to answer is: How can capabilities informally developed and demonstrated by learners be systematically integrated into the process of achievement recognition, and course and programme development? The case study follows three iterations of projects being delivered and analyses the competencies demonstrated by the learners in the projects. This study attempts to identify formally achieved, facilitated informally achieved, and spontaneous informally achieved competencies that learners developed. This research explores the possibilities to start transitioning the emergent spontaneous demonstrations of competencies into facilitated competencies to enhance the consistency of informal achievement across different courses using Leadership in Action as an example. The cases for the project were collected before and after the first Covid-19 lockdowns, and the final project was positioned within the rationales that emerged as part of the shakeup that education went through during the period.

To answer the identified research question, this article will first conduct a literature review to position the study in the historical and research context, and outline a detailed theoretical foundation for analysing the presented case-study. The methodology section then goes into detail about the approach used to analyse and systematically assess the available data. The findings section will explore the specific results of the analysis, while the discussion will present the analysis of these findings in a way that should help answer the research question. Finally, the conclusion will overview the results of the study and position them in context for further research.

## Evaluation frameworks for formal and non-formal learning

The variety and diversity of employment options (McKinsey & Company, 2020) that appear every month makes it nearly impossible to facilitate graduates into employment based solely on the formal programme of education that is predicated on recognisable and traditional industry-specific knowledge and graduate outcomes. Changing formal learning outcomes and creating new programmes that meet current market requirements is time and cost

consuming for institutions. Focusing on formal learning outcomes limits the potential to fully apply the concept of learner centredness (Bailey & Colley, 2015). The pace of disruptions creates an untenable environment for any formal educational programmes that cannot capitalise on informal achievement and that fail to recognise competencies achieved outside of the prescribed learning outcomes.

The concept of a student-centred project-based system has been discussed and researched by, among others, Reigeluth et al. (2015). The team of authors discussed the various functions that their personalised integrated educational system needed to have, and the required network architecture. One of the primary functions that we are interested in here is the reliance on student-led projects as one of the means of facilitating the learning process. The system was designed specifically with the purpose of empowering students to be more independent and have agency over their learning process. The design of the system and the practical experience that went into the planning of its different elements supports the use of student-led projects as a valid foundation for other case studies. The system even offers an implementation framework that allows for allocation of badges, but there is little exploration of the ability to extrapolate these badges into the real-world environment and make them a form of recognition that would be acceptable to employers. Methodologically, this study shows the way for an original case-study to be discussed as a confluence of non-linear processes in a format supportive of the agile post-pandemic project-based learning.

Another important study that becomes only more critical following the pandemic is Gravani (2019), examining experiential and learner-centred practices for enhancing online studies. The author highlights the value that even unintentional reliance on student input and agency in programme design creates for the education programme, yet recognises the challenges that are imposed by the formal nature of tertiary education and the inertia that exists in amending or changing the programmes to more efficiently fit the needs of the learners. There is also no mechanism for recognising the input that students have, despite the benefits that their participation brings. It must also be mentioned that, while multiple authors consistently test and highlight the benefits of experiential learning and learner-centred approaches in education both online and off-line (Altay et al., 2016; Wei, 2018; Zhukov & Staples, 2020), there is a significant drawback – the impact that these educational practices have on the facilitators' workloads (Bailey & Colley, 2015; Dai et al., 2020). For educators, the topics that are raised in this research have never been trivial and have only been exacerbated and sharpened in the wake of the Covid-19 lockdowns. This was the context in which the current research was conceptualised and conducted.

The rapid changes during the Covid-19 period that swept up most of the stakeholders in the tertiary education process shifted the focus from formal programme components to other levels of structured involvement and planning, namely, facilitated learning opportunities and spontaneous educational interactions or student-led outputs that extended beyond the limitations of the formal programme documents. Various scholars have explored the informal side of education, which refers to communities of practice, networking, on-the-job training, mentorship, and other forms of interactions outside of formal educational programmes (Lave & Wenger, 1991). In their influential book *Situated Learning: Legitimate Peripheral Participation*, Lave and Wenger (1991) identify two distinct approaches to learning: through *teaching curriculum* and through *learning curriculum*. *Teaching curriculum* is seen as a collection of learning resources, mediated through the participation of the instructor; whereas *learning curriculum* is the knowledge gained by the learner through participation in a variety of practical activities, first by staying on the periphery and engaging in smaller associated activities and later participating directly in a variety of activities associated with professional practice (Lave & Wenger, 1991, p. 97). The learning curriculum as an element of the community of practice explores the notion that the “problems of schooling are not ... pedagogical ... [but have to do] ... with the places that newcomers can or cannot find in such communities, and with relations that can or cannot be established between these newcomers and the cultural and political life of the community” (Lave & Wenger, 1991, p. 100). When this understanding, initially construed in the context of apprenticeships and on-the-job learning, is applied to an academic context, it gives foundation for an initial differentiation between a formal and mediated curriculum and informal ‘lived’ curriculum.

Knight et al. (2006) differentiate learning along two primary criteria – formality (formal and non-formal learning) and intentionality (intentional and non-intentional learning). Their classification includes four combinations of these

two criteria. Formal intentional learning refers to formalised curriculum-based programmes that culminate in the achievement of formal learning outcomes. Formal non-intentional learning is the hidden curriculum, or “learning about the logic-in-use (as opposed to the espoused logic of the prescribed curriculum)” (Knight et al., 2006, p. 327). Non-formal intentional and non-intentional learning is removed from a curriculum and happens outside of the traditional educational settings, and is differentiated as reflection (either self-directed or with a mentor/peer group and learning by doing). The intersections of these modalities of learning are presented in the context of professional development and highlight the complexity of balanced learning, where predominantly non-formal sources may lead to stagnation of the learning process. In the context of educational programmes, this potential shortfall is reversed, and the formal curriculum may stagnate if devoid of emergent practice, reflection and application.

Hoessler et al. (2015) provide an excellent analytical methodology for evaluating informal learning, and highlight, among other things, a strong reliance on spontaneous and informal learning opportunities among the students. Their study of spontaneous and facilitated learning opportunities stresses the importance of recognising these as valid sources of knowledge at the institutional level and beyond. At the same time, some of their results demonstrate that without formal recognition most spontaneous learning may be ignored within a formal setting, hence the overwhelming reliance of faculty and staff on formal learning, in contrast with the students (Hoessler et al., 2015). Since the study looks at the learning opportunities within a practical employment scenario, albeit employment in academia, that supports the thesis that informal and, occasionally, unintentional outputs and student-centred learning environments lead to students being better prepared for the transition between study and work, which could be further leveraged if the informal educational aspects could be recognised in a more meaningful way. Since the pandemic created a lot of uncertainty, intentional analysis and recognition of all forms of student interactions within their personal learning environment becomes critical.

The focus of the literature selected to inform this research highlights a persistent interest in informal mechanisms of support and recognition in higher education. The fact that learners in post-secondary settings bring their experiences and implicit and explicit knowledge into the educational setting stresses the importance of the research question identified in the introduction: How can capabilities informally developed and demonstrated by learners be systematically integrated in the process of achievement recognition, and course and programme development? For the purposes of this study, we complemented these understandings of various levels of formality and intentionality with the classification of learning opportunities into formal, facilitated and spontaneous, as suggested by Hoessler et al. (2015). To create the differentiation between different types of learning as applied to project-based educational activities, we are going to assess the learning activities along the criteria of formality and intentionality, using achieved competencies as a representation of the relations established by the learners in the professional community in which the learning is taking place.

Table 1. Framework for differentiating formal, informal facilitated, and informal spontaneous learning.

		Types of learning (expressed through achieved competencies)		
		Formal	Informal Facilitated	Informal Spontaneous
<i>Criteria</i>	<i>Formality</i>	Based on the course outline and learning outcomes Compulsory for qualification	Based on hidden curriculum Non-compulsory for qualification	Unplanned Non-compulsory for qualification
	<i>Intentionality</i>	Facilitated by the educator Intentionally achieved by learners	Facilitated by the educator Non-intentionally achieved by learners	Not facilitated by the educator Non-intentionally achieved by learners

Hoessler et al. (2015) discuss different focus areas in their study of formal, facilitated and spontaneous academic development through a variety of evaluative lenses. The focus modalities of learning are roughly adapted from Knight et al. (2006), and Lave and Wenger (1991). The theoretical lenses used to analyse these modalities of learning are:

1. Traditional framework – measures awareness, attendance, and usefulness of various formal support structures available to the students. This theoretical lens looks at the methodology and findings based around previous studies of formal intentional and non-intentional opportunities available to postgraduate students, for example in the report by Golde and Dore (2001). The traditional measures of competency achievement are already integrated in the reporting and recognition structures of formal and informal facilitated learning. The framework is particularly important for assessing the effectiveness and usefulness of informal facilitated learning, development of soft skills, and engagement with existing learning opportunities in and out of the classroom. In the context of our study, the traditional framework is already used in the Learner Capability Framework (LCF) (Otago Polytechnic, 2021a). It is also important to use this framework if or when informal spontaneous capabilities are integrated into the recognition mechanisms used by educators and tertiary education organisations.
2. Ecological framework – explores five ecological levels (based around micro, meso and macro systems explored by Bronfenbrenner [1996]) on which formal and informal learning opportunities may be developed and applied, starting with the individual learner and finishing with the higher education sector. The framework was largely adapted using the work of Fraser et al. (2010) and Trowler (2005). Our research largely explores the micro level, i.e., the interactions between educators and students, and the competencies achieved by the students. However, it is important to understand the model of interactions and the interconnectedness of these ecological levels so that informal spontaneous learning can be recognised and integrated into the domains of influence at the classroom, faculty, institution and sector levels.
3. Complexity framework – this approach helps bring together the understanding of the learning system less as a sum of complex moving parts, but more as a system that in its interconnectedness develops characteristics different to the characteristics of individual elements. This aligns with the approaches to complexity used to analyse a whole plethora of anthropocentric processes (Prigogine, 2008; Prigogine & Stengers, 2017; Urry, 2003), the non-linear interweaving of elements in educational systems (Davis et al., 2013; Fenwick et al., 2015; Jörg, 2009; Jörg et al., 2007) and, among others, the complex interweaving of social networks in the educational process (Gilstrap, 2011) and integration of complex systems into personal learning environments (Dabbagh & Fake, 2017). The complexity framework is important in identifying the informal learning, whether it is facilitated or spontaneous. The traditional framework and the relatively linear, even when modular, approach to the student journey does not lend itself well to recognising the networks of competencies employed in achieving the outcomes of project-based assessments. This framework was used in our study to deconstruct elements of complex project-based assignments to understand the elements that were being overlooked in informal spontaneous, or even informal facilitated, learning.
4. Developmental evaluation framework – an approach adapted from Patton (2011) that is used to make sense of complex systems where the control may not be present with any one of the parties engaging in the non-linear systems. Specifically, this framework “expects uncertainty and unpredictability as given in complex and dynamic situations ... [and] ... learning to respond to lack of control; staying in touch with what’s unfolding and responding accordingly – and agilely” (Patton, 2011, p. 26). This framework was important to help educators and faculties explore their processes and engage with recognition of informal achievements. In the conditions of the pandemic, and now post-pandemic, the ability to adjust processes across various ecological levels may be particularly limited if educators were to understand their work narrowly and not change their approaches based on the rapidly developing circumstances. It is the hope of the researchers that the integration of spontaneous achievements in the traditionally rigid processes could result in a more agile learning environment, especially in the vocational education and training (VET) sector.

## RESEARCH METHOD

### Case study

This research adopted a qualitative case study (Yin, 2009) as the research method. Qualitative case studies allow researchers to investigate a research object such as an individual, an event or a group of people through rich data and extensive real-life context for generating “many more variables of interest” (Yin, 2009, p. 2). This research intended to find out how and why informal capabilities are developed in project-based assessments and benefit learners’ future employability. The research object was the learners and their behaviours and actions in completing their projects. Each project from preparation to completion required 3–4 weeks for the learners. As the projects were group projects, many interactions and dynamics occurring within groups provided rich data for the researchers to discover unknown reasons and means for the formation of informal capacities. The learners were from a wide range of cultures, which also made the project contexts more varied.

All learners who join the OPAIC campus are international. For the purposes of developing class activities, assessments and other course materials, this means that none of the learners come equipped with the implicit knowledge that may be fairly standard in people going through the school system in Aotearoa. It also means that drawing on the knowledge of the students’ personal culture in class results in a very diverse set of outputs and could result in interesting, spontaneous learning. This was one of the reasons why the project assignment encouraged the students to draw on their cultural knowledge to create their project outputs. The intention was to ensure that there was a source of cultural knowledge that students could draw on and help others start getting knowledge about their cultures.

### The case context

The case study looks at learner experiences in one core course taught in the undergraduate programme of studies for the Bachelor of Applied Management qualification – Leadership in Action – following a redesign of assessments in June 2019. The focus was specifically on an assignment that requires the students to create a team project that communicates cultural practices to a wide range of audiences and develops leadership skills for the learners. The redesign fitted the course into the institutional culture of New Zealand polytechnics, which are positioned to deliver applied, experiential and employment-oriented learning. More specific reasons for selecting a project-based assessment included, first, that it required the students to demonstrate a wide variety of skills and competencies without necessarily spelling out each one of them in the course descriptors; and, second, the open structure of the assignment and the freedom of the students to select the scenarios that they liked and wished to pursue allowed the facilitator and the students to co-create dynamic content that expanded beyond the formal structure.

The course learning outcomes that were directly or overtly described (including cultural awareness and knowledge) were considered part of formal learning and were not examined in detail, as they were out of scope for this study. These course learning outcomes were, however, used to differentiate the formally achieved competencies from the informal competencies, which are listed below.

1. Justify the choice of leadership style(s) for specific situations that also recognise cultural diversity and/or cultural contexts.
2. Participate ethically in various team roles to inspire others and self to achieve desired outcomes.
3. Students evaluate their own current leadership potential (skills, abilities and knowledge) using reflective practices and feedback to propose actions for their leadership development.



## Data and data analysis

The case study selects ten team projects implemented in three different study blocks in 2020. Several iterations of deliveries demonstrated great effectiveness of the assessments in developing learner capabilities and enhancing learner engagement in the leadership projects. Students' project reports, reflections on the development of their leadership competencies, public reviews of the projects posted on social media, semi-structured interviews of nine students, and the teacher's written feedback on the submitted assignments for the projects were collected as data for the case study. All data other than interviews is secondary information that is available on Moodle.

The collection of the primary data was approved by Otago Polytechnic Research Ethics Committee (reference number AIC72). A proxy sent invitations to 30 students who had completed their studies in the leadership course. Only nine students responded with their signed consent forms. Each interview was conducted in English by the proxy using set questions, including a description of the student project, their reasons for the project selected, skills used to complete the project, students' perceived skill development, descriptions of the situations/group dynamics from which the skills were developed, challenges experienced, and importance of the skills to their future life or work. Each interview was about 30 minutes and recorded by an audio recorder or via MS Teams. All interviews were transcribed verbatim.

The data-analysis method was basic content analysis, which simply coded the interviewees' words for the identification of the competencies they perceived as developed from the leadership project. Information provided in other data sources was used to validate and complement the information provided by the interviewees.

The Learner Capability Framework (LCF) published by Otago Polytechnic (2019) was used to define the codes for the data. The Learner Capability Framework initially consisted of 25 capability groups that each consisted of 2–3 more-specific capabilities. An example of such a capability group could be:

1. Communicates effectively in writing
  - a. Use different styles and types of written language appropriately to convey information.
  - b. Apply appropriate tone, and writing style to meet audience needs.
  - c. Read and understand written text and figures. (Otago Polytechnic, 2019a, p. 36)

The 25 original capability groups were used to map the codes for the capabilities in the projects, which resulted in a total of 68 codes. The latest version of the LCF added the 26th group, "Participate in behaviour change", which included four capabilities. but the group was not included in coding as the capabilities did not correlate with any of the skills identified in the data. Each learner capability was identified as one code. As demonstrated in the example above, competencies a, b and c were used as three separate codes. Additional learner capabilities identified in this project but not included in the LCF were verified by an independent learning specialist and then added to the prototype framework for evaluating informal learning. Codes identified from different data sources were compared and reconciled to enhance the reliability of findings.

All identifiable codes were further categorised into three groups (formal, informal and spontaneous), according to the framework presented in Table 1. In this case, spontaneous informal achievements are defined as capabilities demonstrated by students that had not been planned by the facilitator or expected in the formal course documents, whereas the facilitated informal achievements are planned for through assessment design or course materials; yet neither one of the two are recognised in the learning outcomes for the course (hence, informal). The formal group was created by comparing the capabilities with the Learning Outcomes and the indicative content in the course descriptor. To design the facilitated informal achievements group, the project used the assessment instructions as a reference point. A complexity framework was applied to deconstruct the capabilities from the interweaved network of evidence, including interviews, assessments and portfolio evidence submitted by the students, written feedback from the lecturers, reflection reports and evidence of teamwork in class materials. The

design of the assessment facilitated this, as the students were required to provide evidence of teamwork, including meeting minutes and planning documents.

Relative applicability of each code to the current job market was also examined. A complexity framework was used to interpret the formation of the learner capabilities and position them in the networks created through the educational process and the work on the projects. An ecological framework was used to interpret the level of intentionality and formality of the capabilities, first at the stage of their inception and then at the stages of their application and assessment.

## FINDINGS

In the findings we discuss the importance and relevance of facilitated and spontaneous informal educational outcomes in the context of the graduate profile of the qualification, the skills identified by potential employers in the region, and the industry advisory committee.

As presented in Table 2, the analysis found that across all ten projects the students demonstrated a total of 36 different competencies in 22 capability groups, with 17 formal competencies, 13 informal facilitated competencies, and six informal spontaneous competencies. Seventeen formal competencies directly related to learning outcomes and graduate profile outcomes for the qualification, which meant they were approved at the macro level of the higher education system and were universally accepted and used to measure the quality of the course. The informal facilitated competencies were captured and developed at the meso level, as the faculty generally expected these capabilities to be the foundation for formative learning activities and to be facilitated by the educators. On the other hand, spontaneous informal capabilities largely related to the micro level, i.e., the level of individual students or students working within their own educational networks.

Table 2. Summary of developed competencies.

	Capability Group	Code	Competency
Formal	Communicates effectively verbally	4	Uses verbal and non-verbal language appropriately
	Displays cultural competence	11	Respects and embraces diverse perspectives
		12	Understands other cultures and engages appropriately
	Works in teams	20	Builds trust and collaboration
		21	Plans and completes projects by deadlines
	Reflects on performance and applies personal learning	22	Develops self-awareness
		23	Engages in reflective practice
		24	Pursues personal learning and change
	Thinks creatively	44	Inspires, collaborates, communicates and delegates
	Displays leadership	46	Motivates, listens and co-creates; values other people
		47	Challenges and resolves inappropriate behaviour respectfully
	Inspires others	48	Motivates others to take opportunities
	Practises ethically	56	Manages own behaviour and acts ethically
		57	Maintains best practice and equity
	Thinks critically	59	Identifies opportunities and overcomes obstacles
		60	Evaluates information and research, and act on conclusions
Solves problems	62	Collaborates to solve problems	



Informal Facilitated	Communicates effectively visually	7	Uses different methods and styles of visual language
	Displays bicultural proficiency in an NZ context	16	Demonstrates an understanding of the Treaty of Waitangi
	Works independently	17	Organises commitments to meet deadlines without supervision
	Acts responsibly	25	Responds proactively
		28	Accepts responsibility for projects and results
	Demonstrates digital competence	32	Applies digital technologies in work contexts
		33	Is digitally proficient online
		34	Uses social media appropriately
	Organises effectively	37	Plans and prioritises
	Demonstrates resilience	39	Perseveres and plans actions
		40	Maintains optimism under adversity
		41	Embraces new ideas and realities
	Performs community service	68	Engages in community action
Informal Spontaneous	Communicates effectively visually		Video shooting and editing
	Organises effectively		Project budgeting and fundraising
			Event promotion and management
	Practises sustainably		Tree planting
	Displays work-life balance		Cooking
		Dancing	

The achieved formal competencies included traditionally sought-after qualities such as effectively working in teams, thinking critically about the tasks, demonstrating effective problem-solving skills, and effectively communicating ideas through several media; competencies already validated at the macro level through the New Zealand Qualifications Authority (NZQA) approval of programme documents.

These were traced back to 13 facilitated informal competencies, which were not part of the programme documents, yet corresponded to many of the skills required for a number of jobs in the region, based on information provided by job-search websites, and were relevant to the emergent skills that were critical post-pandemic: effectively using visual languages, understanding the Treaty of Waitangi application to practical projects, working independently without supervision, demonstrating digital competence, and having high levels of resilience in facing adverse environments. These competencies were discussed and worked into the hidden curriculum during pre-moderation meetings, faculty discussions, professional development sessions, and in community of practice meetings, all of which represent the meso level.

Elements that the students spontaneously brought to the list of competencies included effective video shooting and editing, budgeting and fundraising, promotion of events, contributing to environmental sustainability of their communities, and displaying commendable ability to maintain a reasonable work-life balance by weaving personal interests into projects. See, for example, a student explaining the genesis of their team project:

*"We just discussed among ourselves, did some brainstorming, we disagreed about what we could do. We first wanted to go to the zoo, which would be very costly and what were we going to do, just learn animals? [Another student] decided to contact CPNZ, because volunteering is completely free and we don't have to pay anything, and in that way we can cut grass, plant trees, do all sorts of stuff. I think it's better that way."*

In this instance the team of students wanted their project to have an environmental theme and one of the initial suggestions was to make a short film about the animals in the Auckland Zoo, but the discussion then led them to reconsider, and volunteer for native bush replanting. The students provided a travel schedule, budget, impact analysis and a short film about their volunteer work, none of which were specifically identified in either the course descriptor or the assessment documents.

One spontaneous competency developed amongst all the student projects was visual communication skills. For effectively communicating their project to the public and making an impact, all groups chose to use at least one social media platform (i.e., YouTube, Instagram, Facebook) for displaying their videos. Video editing became essential after taking much raw footage. One student recalled:

*"We started collecting old pictures and videos. A lot work was on my phone. I started picking the most meaningful and needed, and then moved them to a different folder. We didn't have a video editor. My brother was in New Zealand has a cracked file of Adobe Premiere, so I took it from him. On 21st and 22nd, I spent both days learning how to use Adobe Premiere. It is kind of complicated as you look at it."*

A student from a different team had a similar experience:

*"We had an issue with the video where we did the introduction. You can hear the sounds of wind. Whatever we say is not heard properly. I had to edit that part. ... We wrote the script of what we said and we recorded each of our voices. And then I just put it in the video itself. And then the next day, 16th or 17th, I uploaded on YouTube with the description."*

Video editing skills, such as compiling footage and reproducing sound, were developed spontaneously for completing the projects. The learners actively and independently learnt these skills by watching YouTube videos or reaching out to their friends and family. Although the assessment only required the students to use evidence to evaluate the effectiveness of their leadership, making videos and gaining public attention are the most convenient channel to demonstrate their leadership and gather impartial evidence.

The development of these competencies can be attributed to the micro level, one of the three major levels of the ecological framework, the others being meso and macro. One of the sources of spontaneous competencies was the personal learning network of each student, comprising the learning networks created in the project teams and the extended learning network to the public. The complexity of project-development requirements and interweaving of experiences within the project teams called for the students to draw on their interests and resources. This led to the development of complex personal networks for each student, which interacted with other networks and enhanced the exposure of each student to activities not planned for, formally or informally, during the development of the courses, at any of the ecological levels. This is one of the reasons to explore project-based assessments and the competencies developed by teams of students through the complexity framework, and to consider the complexity of the peer-support groups in the design and implementation of assessments.

## DISCUSSION

Interviews demonstrated a lack of awareness amongst the students of their achievements as part of the projects. Most students struggled to look beyond what was formally assessed in programme documents and didn't show awareness of potential benefits that could be extracted from their personal learning experience to facilitate the job-search process. For example, a student struggled to see the benefits of independently learning and using Adobe Premiere Pro for video editing, which demonstrated several competencies that are important for future employment and are partly mapped in the Competency Framework. The student quoted above, who learned how to use Adobe Premiere Pro, did not mention the software as a skill developed during the project.

This is one of the examples of the informal spontaneous competencies identified earlier, namely "video shooting and editing." The fact that the student went to the lengths of teaching themselves how to work with new software and never recognised this as a competency they acquired as part of the course shows the relatively narrow view of

their learning, which needs to be taken into account during the design of the assessments, courses, programmes and qualifications. The fixation on the formal side of the qualification also limited their choices of jobs, not because they lacked the skills, but because they could not establish the connection between their previous achievements and job requirements. This further highlighted the need for creating a reflective culture of recognition within the organisation, not only to motivate the students, but to develop them as critical thinkers and reflective practitioners.

The ability to reflect on the experiences emergent from complex personal learning networks allows students to maximise the leverage they have when positioning themselves in the job market going forward. While not all competencies may end up being directly applicable to a student's circumstances, the ability to quickly adapt to the needs of a situation and to be flexible under conditions of uncertainty is likely to translate into a competitive advantage for the student. Reflection can thus be a technique to move the competencies from a pool of passive and dormant competencies into active and applicable, creating a practice of developmental evaluation at the micro level. There is also great potential for future streamlining of reflective developmental evaluation practices at the meso level, and a hope that one day the macro level is able to consistently participate in these practices. But the analysis of the meso and macro levels can be undertaken at a future point.

Among the competencies grouped under "Digital competencies" was the use of social media. Even though the assessment never mentioned social media as a method of presenting portfolio evidence for the projects, virtually every student ended up using this. Use of social media and exposing student projects to external critique proved to be highly beneficial for motivating them and sparking creativity within project teams. Positive comments online and 'likes' of student posts made the course more enjoyable and satisfying. Social networks, in this case, work as physical representations of personal learning networks and can be easier for students to access and analyse consciously. While the research shows the complex interconnection of various moving parts that constitute personal learning, the concept of a learning network may be difficult to engage with for a learner. The familiar physicality of social networks helps bridge that gap in understanding of the importance of these networks, either through the engagement of others in the actual projects, or the reflection on the value of peer feedback. However, if left to the students alone, removing this from the purview of the lecturer, the potentially reflective practice is likely to devolve into something that could be harmful for the students' mental health outcomes and further exacerbating the narrow focus on the formal competencies.

The design of graduate profile outcomes for Applied Management qualifications stresses the importance of soft skills, many of which are found among the informal facilitated competencies in the framework. Without systemic understanding of ways to help the students achieve these competencies, and without intentionality on the part of the educator, the design of courses and assignments might not have a meaningful contribution to the learning process of the students engaged in project-based studies. While it was not part of the scope of this research, this finding highlights the importance of the educators in facilitating effective learning, and the importance for the educators to be fully aware of and actively pursuing the achievement of informal capabilities by the learners. While this statement may be relatively intuitive, it is also one that seems to be often overlooked in policy development at the macro level.

The use of public media channels is clearly one of the techniques that needs to be practised at the institutional meso level, but should be best formalised to avoid any potential complications associated with bringing students' work into a public forum. One other recommendation is that any form of acknowledgement that may be employed by the institution in the future should include a formal mark of recognition, similar, for example, to digitally verified badges used to confirm the achievement of micro-credentials. The benefit of awarding such badges to students may be in their purposeful design to work with social media platforms. In light of the findings of this research, it's clear that a large portion of students are motivated by peer recognition through social media. So giving the students an asset to be displayed on social media could motivate them further.

Peer feedback should also be provided in a safe space that allows for different levels of access and moderation, but comparable approaches and their ability to create familiar and (potentially) enjoyable experiences should be sourced and adapted from social networks. It is important not to assign too much meaning to the purely

technological components of the work with student-led projects, in order to avoid the pitfall of traversing into techno-utopism, but a healthy level of understanding of the mechanisms driving social media consumption and the available information on potentially harmful practices associated with social media are likely to give the educators better control and ability to guide the students in the presentation and collection of feedback about their projects. As new processes become familiar to the students and take their place in the social ecosystems, the faculty at the meso level must be prepared to adopt them and make them part of the reflective practice (a sentiment that is particularly resonant in the current scramble to find an approach to ChatGPT, which is rapidly disrupting the sphere of education). This approach could result in meaningful contributions to faculty policies and help step away from the culture of prosecuting the use of new technologies, to the culture of promoting intrinsic academic integrity and responsible use of technological developments in the process of learning.

## CONCLUSION AND IMPLICATIONS

The purpose of the research was to answer the question: “How can capabilities informally developed and demonstrated by learners be systematically integrated into the process of achievement recognition, and course and programme development?” The study explored practical cases where formal, facilitated informal, and spontaneous informal competencies were developed in students participating in project-based assessments at the undergraduate level. The analysis of the cases showed that the students developed 17 formal competencies, 13 informal facilitated competencies, and six informal spontaneous competencies. The project also explored the mechanisms and specific activities that led to the development of informal competencies, whether planned or spontaneous. The resulting discussion highlights the need to include and update programme documents with the new competencies, redesigning or updating courses and assessments as required, and including educator reflections in programme development practices. It also highlights the importance of developing educators as reflective practitioners engaging with practical, current and relevant approaches to facilitating the “hidden curriculum.” For the purposes of this study, the authors consider the question answered, although there are clear possibilities for further research and analysis.

The project is still in the early stages of development, but it has the potential to significantly increase levels of student engagement and satisfaction with project work and, hopefully, allow them to develop skills and competencies that would otherwise be ignored as part of their work in their formal programme of studies. As the culture of recognition is implemented in the work of the faculty and institution, it has the potential to become a norm not just for the staff, but also for current and future students. If recognition of informal achievements is the norm, it could improve the overall perception of formative tasks and create a clearer understanding of value in the minds of students. The culture of recognition is traditionally compartmentalised to a specific ecological level, but the permeation of this culture is likely to make this recognition more meaningful. People and institutions at the meso and macro level who systemically recognise achievements can enhance the development of competencies at the microlevels and facilitate the recognition of value in personal learning networks among students.

The outcome that the researchers expect to occur in the long run is that agile changes to the delivered programme would be effectively communicated to qualification developers and government quality-assurance agencies, to bring together the evidence from multiple stakeholder groups, which include students, faculty and employers, together outlining some of the most important skills and competencies to be added to the national frameworks as there are developed, thus creating a very effective and inexpensive consultation mechanism for developing education policy.

While the idea of institutions at the macro level of the education system recognising informal competencies is appealing, it is also rather idealistic. Even if actualised, if the system of recognition is implemented from the top, it is likely to be added to the workloads of facilitators without a realistic implementation plan. As part of the effort to suggest further work on capability recognition, Table 3 has a proposed workflow plan that looks at the marking and discussion of the results of project-based assignments. While Stage Three, further implementation of project-achievement analysis, could be implemented over significant periods of time, Stages One and Two could potentially

reduce the workload by creating more streamlined marking templates and rubrics, and would have a turnaround time of just one term. Changes to facilitated contents of educational programmes could be initiated within the faculty, without any extra costs or resource requirements, between course-delivery periods, and have the potential to positively contribute to faculty professional development and meaningful engagement with industry advisors.

Table 3. Workflow plan for recognising facilitated and spontaneous achievements.

Marking	<ul style="list-style-type: none"> <li>- Marking comments for project-based assignments will inevitably look at skills and competencies.</li> <li>- The comments describing the competencies are copied into a database. Data entry can be integrated in the marking process to consistently create content.</li> <li>- Data codes from the study could be used as standardised comments or as part of the rubric to streamline the process.</li> </ul>
Feedback	<ul style="list-style-type: none"> <li>- Recognition certificates are generated using a template that pulls information from the database. This allows for recognition of achieved formal and informal competencies. Certificates are accompanied by digital badges.</li> <li>- Project materials and comments are used to present a narrative to the industry advisory board that can be accessed remotely. Comments and recommendations are registered in the database.</li> </ul>
Further Implementation	<ul style="list-style-type: none"> <li>- Competencies that have been through the feedback loop can be used for further course development and curriculum development.</li> <li>- Recognition and analysis of informal achievement can be the driver for change in formal educational outcomes to keep them relevant and agile.</li> </ul>

The workflow presented in Table 3 could serve as a template for future programme and even policy development in the VET sector. At a time of major changes to the education system, there may not be enough attention dedicated to the critical relationship built between educators and students, and the results of their work. But this workflow template may present a potential approach to ensure that the education process remains student-centric, benefits from the experience of the educators, and genuinely includes both students and educators in the decision-making process, not as parties to be consulted with but through verified results of their work and professional contributions. Informal competencies developed in learners have the potential to add currency and value to VET education.

This is one of the ways in which the research can be developed further. As of the time of writing this article, the authors are analysing the data from individual leadership projects. Exploring the nature of informal competencies in a variety of contexts is likely to build on our understanding of developmental evaluation as applied to various ecological levels of the education system.

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# Early Reflections on a Collaborative Research Project About the Safety of Rainbow Ākonga on Te Pūkenga Campuses

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## Practice Paper



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## ABSTRACT

This paper reports on the experiences of a research team designing and beginning to implement a research project exploring how safe and inclusive the various campuses of Te Pūkenga are for Rainbow ākonga (students). As Aotearoa New Zealand's largest tertiary education provider, Te Pūkenga is bound and shaped by current anti-discrimination social policies. Under the 1993 Human Rights Act, discrimination based on gender was banned in Aotearoa. Same-sex marriage was legalised in 2013, and since 2021 people have been able to change their birth sex on official documents. In 2021, the Government also banned conversion therapy. However, despite these policies and as numerous national studies have documented, educational institutions remain hostile spaces for Rainbow ākonga. We aim to investigate ākonga and kaimahi (staff) experiences of inclusivity and discrimination across Te Pūkenga campuses. A research design was established, and we are in the process of collecting data. Because we have just begun the fieldwork at the time of this writing, we cannot discuss our findings to date. Instead, this article uses the feminist method of storytelling to explore the formation of a collaborative multi-site research team, the necessity of consulting with a Rainbow youth organisation when designing the survey, the research team's duty of care to participants, the ethics process involved in conducting a multi-site organisational study and managing 'teething problems' when the online survey went live. This paper thus reports on our experiences of overcoming hurdles associated with a multi-site research project at a time of transition into one organisation, Te Pūkenga.

## KEYWORDS

Rainbow students, inclusivity in education, tertiary education, student safety

## INTRODUCTION

One in every 20 adults in Aotearoa identifies as a member of the Rainbow community (Stats NZ, 2021). Despite their being a significant proportion of the population and legally protected, hate crimes are still committed against Rainbow people. Rainbow people report significantly higher rates of violence and bullying than heterosexual and cis-gendered people (Ministry of Justice, n.d.; Veale et al., 2019). Rainbow people are identified as a population three times more likely to experience mental health issues than the non-Rainbow population (Poupard, 2021), and are more likely to face mental distress and discrimination (Flett et al., 2020). Young Rainbow people experience less supportive family and community environments and are significantly overrepresented in relation to negative health and mental health outcomes relative to their non-Rainbow peers – particularly Māori, Pacific and/or disabled Rainbow youth (Roy et al., 2021).

Currently, there appears to be an increase in anti-queer hate crimes, which may be seen in the arson of a queer support centre in Tauranga, homophobic epithets spray-painted on a queer venue on the West Coast, and attacks on drag queens who deliver stories to children in many of our nation's North Island libraries (Johnston & Quill, 2022). It is little wonder that members of the Rainbow community hide their identities (Dennison & Kitchen, 2015), feel unsafe in public spaces (Veale, 2019) and struggle to obtain a sense of belonging in their communities, including educational communities where colonial and cisheteronormative norms can prevail (Sterling & Tan, 2021). Despite having protective legal measures in place, Rainbow students still experience hostility in many educational settings.

Educational institutions have been identified by the Rainbow community and Aotearoa New Zealand research as failing to provide adequate education and practice on diversity and inclusivity (Sterling & Tan, 2021). Under the 1993 Human Rights Amendment Act, all educational institutions must provide an environment that is safe for all ākonga, including Rainbow students (Smith, 2012).

Numerous studies have been conducted on queer ākonga experiences in Aotearoa's high schools (e.g., McAllum, 2017; Quinlivan, 1996; Sexton, 2015; 2017; Smith, 2006; 2012; Gunn & Smith, 2015; Smith et al. 2016). However, studies conducted in tertiary educational settings and those focusing on gender diversity in all levels of education are more rare, albeit with some notable exceptions. For instance, Carpenter and Lee (2010) conducted a study on sexual diversity with a cohort of ākonga and kaikauwhau (lecturers) in teacher education programmes in one national tertiary institution. A total of 83% of staff participants reported that their campus was not a safe space for queer students. Over half of the queer student participants felt unable to be themselves on campus. Staff and student participants described environments in which heteronormativity was pervasive, there was little mention of sexual diversity in the curriculum, and very few queer people were open about their sexuality.

Two more recent studies provide a contemporary picture of campus life for tertiary Rainbow ākonga. As part of her Master of Professional Practice research, Trueman (2020) interviewed eight sexual- and gender-diverse ākonga from several of Aotearoa's tertiary educational institutions. These participants reported that heteronormativity and cisnormativity were entrenched, as evidenced by the lack of gender-neutral bathrooms, the absence of gender/sexual diversity in the curriculum, and discriminatory forms and policies. Unfortunately, the ubiquity of heteronormativity and cisnormativity meant that the participants felt unable to be themselves, which resulted in various negative psychological impacts. These findings echo Fraser et al.'s (2022b), where significant structural barriers hamper access to support. As within tertiary environments, mental health systems require Rainbow people to negotiate their presence and needs within contexts that presume identities that exclude them, via embedded cisheteronormative practices and assumptions.

Powell and Gremillion (2018) conducted individual interviews with seven self-identifying gender-diverse participants from a range of tertiary educational settings. Although the participants had not experienced physical violence, they reported being subjected to cisnormativity and hostile administration processes, as well as numerous microaggressions. This research project is important, as it is the only contemporary national study we were able to locate that focuses solely on gender-diverse ākonga.

Some existing national studies on tertiary Rainbow inclusivity focus on an intervention. For instance, in one university, transgender ambassadors talked with health students about some of the issues transgender people experience in our national health system (Hayward & Treharne, 2021). Although the students reported learning a lot of new information and the ambassadors enjoyed the experience, we argue that it should not be up to good-willed volunteers to educate health students about the state of health care for transgender people.

It should be noted that although Rainbow youth are statistically more likely to experience bullying, crime and poor mental health compared to their heterosexual and cisnormative counterparts, they are not victims (Smith, 2006). Instead, Rainbow youth are at the forefront of activism, organising such things as pride events and protests against societal laws, institutions and people that discriminate against and oppress them (see, e.g., Nairn et al., 2022; NYU-CIC, 2022). Many also volunteer in Rainbow community organisations (e.g., InsideOUT and Rainbow Youth) and challenge heteronormative and cisnormative educational environments (Quinlivan, 2002a; 2002b; Sligo et al., 2022). This activism was visible most recently when primarily Rainbow young people organised rallies against anti-trans extremist Posie Parker (aka Kellie-Jay Keen-Minshull), which ultimately led to her fleeing from Aotearoa (Radio New Zealand, 2023).

## STORYTELLING

Within feminist research there is a long history of storytelling and sharing personal accounts, methods that challenge more traditional research approaches from which, historically, women have been excluded. Storytelling

forefronts women's accounts, challenging more conventional presentations of research data and findings (de Nooijer & Sol Cueva, 2022). In feminist storytelling the personae of researchers are included, and it is a reflexive process that includes vulnerability. Feminist storytelling has a long history within qualitative research approaches (Klages et al., 2019), and is a tool widely used by Rainbow populations, whose experiences have been excluded not only from research, but also from standard historical accounts more generally (Boatwright, 2019; Burford et al., 2015; Valentine, 2008).

Given that we have just begun the process of data collection for our research study exploring how safe and inclusive the campuses of the various business divisions of Te Pūkenga are for Rainbow ākonga, we cannot report on our findings at the time of this writing. Consequently, we provide a personal narrative account of the formation of our research team, the process of survey design, the necessity of the duty of care for participants, the process of securing ethics and problems that emerged in the data collection. Although mistakes in research are relatively common, often they are sanitised from research reporting. In contrast, some researchers have used errors or hurdles in research processes as opportunities to be reflexive, welcoming these moments as learning opportunities (e.g., Fraser et al., 2022a; Nairn et al., 2005). In this paper we discuss errors in our ethics and data collection processes to reassure emerging researchers, in particular, that such mistakes are relatively common and cannot always be anticipated. In this way, the paper brings together themes from existing research on storytelling as feminist method and on challenging research situations as opportunities for reflexivity.

## TERMINOLOGY

Before we begin, however, we need to provide a small glossary of terminology that will be used in the paper. Firstly, the term 'Rainbow' is an umbrella term used to describe people with diverse genders, sexualities and sex characteristics (InsideOUT, n.d.). It is also used by those who do not feel comfortable with terms such as queer or the acronym LGBTQIA+. It should be noted that there are many other terms for the plethora of sexualities and genders that people enact in society, which can be accessed here (<https://insideout.org.nz/wp-content/uploads/2021/11/Making-Schools-Safer.pdf>). Young people are more likely to take up the plethora of new terms for diverse sexualities and genders that have emerged in recent years.

The term 'heteronormativity' was originally coined by queer theorist Michael Warner (1991) and refers to the societal assumption that heterosexuality is the 'normal' or default sexuality. This assumption underpins many social practices and, until relatively recently, laws preventing same-sex marriage and adoption. 'Cisnormativity' refers to the assumption that people's gender follows from their sex assigned at birth, which excludes people who are transgender (Horton, 2023). Like heteronormativity, cisnormativity is embedded in our social fabric as well as in many of our educational institutions, as evidenced by school cultures that permit abuse and fail to include any information on transgender people in the curriculum. Transgender students also experience micro-aggressions, such as teachers/lecturers failing to recognise their preferred gender.

## RESEARCH OPPORTUNITIES AND TE PŪKENGA

Te Pūkenga (n.d.) is the largest national tertiary education provider in Aotearoa and, given its recent formation, it is an optimal time to conduct a study on the experiences of Rainbow ākonga across its various business divisions, which were formerly known as Institutes of Technology and Polytechnics (ITPs). It should be noted that the nine Independent Training Organisations (ITOs) were also encompassed under the umbrella of Te Pūkenga; however, given that many ITOs do not have a formal physical campus, it was decided to concentrate our study solely on ITPs. Nevertheless, given that Open Polytechnic delivers online learning only, then we excluded this business division from the study. Consequently, a research study with the overarching aim of exploring how safe and inclusive these various 15 business divisions of Te Pūkenga are for Rainbow ākonga was begun in the later stages of 2022.

The formation of Te Pūkenga has the potential to grow research associations across business divisions, and thus, invitations for research collaborators were sent to various research offices. A research team consisting of seven

members (from five business divisions) with an interest in research with Rainbow ākonga was subsequently formed. The team consists of three members of the Rainbow community and four allies. Despite the lead researcher's efforts to attract a diversity of sexualities, genders and ethnicities to the research team, team members are all Pākehā, primarily cisgendered women with two non-binary members, while all are somewhat removed from youth culture.

Many studies undertaken on Rainbow sexualities and genders in Aotearoa have focused solely on Rainbow ākonga (e.g., McAllum, 2017; Trueman, 2020). However, given the role they play in creating campus environments, it was decided that kaimahi as well as heterosexual and cisgendered ākonga perceptions are also needed (see Nairn & Smith, 2004, for a similar study). Considering, for example, that homophobic and transphobic humour and abuse contribute to establishing normative gender and sexual identities, studying heterosexual and cisnormative ākonga understandings is important (McCann et al., 2010). Moreover, specific questions on the survey asked participants if their classes (as kaimahi or ākonga) included meaningful discussion of diverse Rainbow sexualities and genders. Arguably, if we conducted research without grouping Rainbow and non-Rainbow kaimahi under one umbrella, then this would result in skewed responses to these questions. The research hopes to identify what is working well currently to create safe and inclusive environments for Rainbow ākonga, and where improvement may be needed.

## THE IMPORTANCE OF CONSULTATION

The research team designed two surveys, including one for cisnormative and heterosexual ākonga and all kaimahi (regardless of sexuality and gender). Given this survey is aimed at collecting data to contextualise Rainbow experiences, only closed Likert-scale (five-option) items are included on Survey One. Likert scales are useful because they gather more data than simple yes/no responses and invite responses based on intensity of feelings (Barua, 2013). A second, more detailed survey was designed specifically for rainbow sexuality and/or gender-diverse ākonga. This survey includes many of the same Likert items as the first survey, but these were shifted to include first-person qualifiers. Open-field questions are also included to gain more in-depth data, given the research focus.

Given the lack of ethnic diversity on the research team, both surveys were discussed with takatāpui and Pacific members of InsideOUT. InsideOUT is a Te Whanganui-a-Tara Wellington-based Rainbow charity, which provides resources, support and advocacy for Rainbow youth, as well as training for educators on safe and inclusive practice. The volunteers from InsideOUT raised issues regarding one statement on the kaimahi and heterosexual/cisgendered survey, which was "Rainbow students should not be welcomed on our campus." They interrogated the purpose of this question, which was to gather information on those who had anti-Rainbow prejudice, explaining that those kaimahi and heterosexual/cisgendered ākonga who strongly agreed or agreed with this option would be unlikely to complete the survey. On reflection, the lead researcher agreed this question was unsuitable as all kaimahi have a legal (under the Human Rights Act, 1993) and a moral duty (given the negative experiences reported by many Rainbow students) to welcome all ākonga regardless of sexuality or gender.

The team at InsideOUT also alerted the researchers to the multitude of terms for diverse Rainbow sexualities and genders, some of which the research team members who initially drafted the surveys had been unaware of. These terms include 'demi-boi/demi-girl', 'Mx' (non-binary) and 'bigender', for example. Moreover, initially the terms 'takatāpui' and 'fa'afafine' were the only ones used in the survey questions to refer to Māori and Pacific Rainbow peoples. However, consultation with takatāpui and with Pacific members of InsideOUT introduced the research team to additional relevant Māori terms (e.g., 'irawhiti', 'tāhine', 'whakawahine', and 'whakatāne') and the acronym MVPFAFF+, which is representative of some (not all) Pacific identities, including mahu (Hawai'i and Tahiti), maka sa lewa lewa (Fiji), palopa (Papua New Guinea), fa'afafine (Sāmoa), akava'ine (Rarotonga), fakaleiti (Tonga) and fakafifine (Niue).

The young people also alerted the research team to the fact that we had left off any questions regarding disability, noting the dual impact that heteronormativity and ableism may have on students who face both forms of oppression. Although the research team had identified dual forms of oppression based on ethnicity and sexual/gender diversity, we had not considered the dual oppression that Rainbow ākonga may experience if they have a disability. Consequently, a question was added based on this feedback, asking whether participants had a disability

(‘yes’, ‘no’, ‘unsure’ and ‘prefer not to state’ response options). Those who ticked the ‘yes’ response are directed to a further question: “Have you experienced any prejudice or discrimination in your polytechnic because of your gender, sexuality and disability?”, with the same response options. After the consultation process was undertaken, the two surveys were checked and finalised by the research team.

## DUTY OF CARE AND ETHICS PROCEDURES

Given that rainbow youth have been traditionally overrepresented in statistics for poor mental health; homelessness; experiences of being ostracised by families/whānau, school and communities; and substance abuse, the research team is aware of the heightened need for a duty of care for participants (Fenaughty et al., 2021; Fraser et al., 2022b; King-Finau et al., 2022). At the same time, we are aware that reporting such statistics may inadvertently frame Rainbow identities as sad and depressing conditions (e.g., see seminal queer education theorist, Britzman, 1995). It is not being Rainbow that leads to overrepresentation in such negative statistics, but rather heteronormativity and cisnormativity that cause Rainbow peoples’ stress (Smith, 2015).

As researchers, members of the Rainbow community, parents of Rainbow gender-diverse children and supportive allies, the research team members embrace a duty of care to ensure that if participating in the survey brings up any discomfort, ākongā are directed to appropriate support resources. After all, it is a central tenet of education and qualitative research to care (Head, 2020). The research team is aware that participating in research has the potential to bring up issues for some Rainbow ākongā. Thus, on the survey form, links to Rainbow groups at each separate business division are included, as is a general list of other national Rainbow support organisations.

Most tertiary educational organisations undertaking research have ethics review boards (in the USA) or committees (in Aotearoa), which require researchers to apply for consent to undertake research (Head, 2020). While these committees can, at times, be restrictive and overly bureaucratic, their aim of course is to help to ensure that research is ethically sound, and effective ethics committee processes balance consultative approaches with compliance requirements (Gremillion et al., 2016). Our experience with ethics was appropriately balanced. Reviewers recommended that the research team split the first survey to render a separate one for kaimahi and another for heterosexual and cisgendered ākongā. It was also suggested that we remove the neutral response in the Likert scale, as it would not provide weighty data, and add an N/A to Likert items. The research team decided not to split the first survey, as this survey was specifically designed to provide data to contextualise the responses of Rainbow ākongā. Moreover, if we were to add a third survey, we contend that it would have been more useful to split the kaimahi into Rainbow and non-Rainbow, as there is a long history of Rainbow educators in Aotearoa and elsewhere navigating heteronormative and cis-normative campuses (Carpenter & Lee, 2015; Lee, 2020). It was also decided to keep a neutral point on the Likert scale response option, as this is standard practice and would provide a more thorough account of participants’ emotional responses to the survey items; however, an N/A category was included as per ethics review feedback.

Multi-site studies are relatively common but tend to introduce more logistical complexities than single-site research projects, especially when multiple ethics and site approvals are needed (Barnett et al., 2016). Although the 16 business divisions of Te Pūkenga have been brought together into one overarching organisation, each has a different process for gaining permission to undertake research with their kaimahi and ākongā. In some instances, Chief Executive Officers or those with high-level research positions have granted permission to distribute the survey on the basis that it had been approved by the first ethics committee, while other business divisions required the full application to be approved by their institutional ethics committees. To date, it has taken ten months to obtain approval to distribute the survey in 15 business divisions.

In their multi-site research focusing on the health of children and adolescents amongst detainees in Nauru detention centres, Samir et al. (2021) reported that the lengthy process of gaining state government and ethics approval meant numerous months of valuable research time was lost. They recommended that multi-site researchers consult with ethics committees early, ensure they use the correct forms, and expect lengthy delays. Samir et al. (2021) also proposed that Australia create one “nationally agreed framework whereby ethics and



governance committees across jurisdictions communicate with each other, use the same electronic platform and present a unified process whilst protecting the welfare, rights, dignity and safety of research participants” (p. 16). The research team suggests that ethics processes across business divisions of Te Pūkenga should be more unified and streamlined and, ideally, have an online platform for application submissions. We are aware of, and encouraged by, initial attempts made by a working group of kaimahi (from across business divisions) to explore issues related to ethics across Te Pūkenga, and to establish an organisation-wide ethics application form (currently under development).

## MISTAKES AND ISSUES

Each member of the research team checked over the survey prior to its distribution, with one member checking the flow of the online survey. Unfortunately, however, when the survey went live at one business division, the response options for two separate questions on Survey One (targeting heterosexual and cisgendered ākongā as well as all kaimahi) were inadvertently merged. Therefore, we learned that the quality-control measures we put in place were insufficient. We know, however, that such mistakes are common in research, as are errors in research reporting (see, e.g., Biemer, 2009; Ezeala et al., 2013; Nairn et al., 2005). Some feminist and qualitative researchers use these errors as an opportunity for reflection and learning, and to inform further research (Fraser et al., 2022a; Nairn et al., 2005).

As the survey was live, we decided not to correct this error immediately, as we would lose initial data. Fortunately, the design of the merged questions allowed for responses within the faulty survey that met its data-gathering requirements, despite the error. The survey was fixed prior to the next dissemination, with the first cohort of participants’ responses manually entered in accordance with the response option categories for the two questions. It is necessary to discuss such errors alongside completed research reports, as they impact on the data collected and are also a part of the role of being a researcher (Fraser et al., 2022a).

There was also an error on the consent form attached to the top of the online survey. The main body of the application to the first ethics committee stated that all kaimahi are eligible to participate, but wording on the survey itself restricted kaimahi participants to classroom teachers. This wording was a mistake, which inadvertently served to exclude kaimahi in support services roles, who play a vital part in advocating for, and helping rainbow ākongā. It should also be noted that one of the research team is employed in an ākongā support role. This issue was brought to the attention of a member of the research team who, after consulting with the first researcher, informed support ākongā they could participate. As noted below, this issue was remedied after the cessation of data collection at the first business division.

When working in a research team, conflict is inevitable as members vary in terms of background, personality, research expertise and interpersonal skills (Foncubierta-Rodriguez et al., 2021). There are also institutional constraints to navigate, such as (sometimes cumbersome and time-consuming) administrative processes required by ethics committees. When it came to resolving the issue of inadvertently including the word ‘teaching’ on the information sheet, tension arose amongst members. Initially, some considered embracing the restriction to teaching kaimahi due to the burden involved in re-litigating ethics approval, but it was quickly decided that our intended kaimahi participation criterion needed to stand. When considering next how the relevant error could be fixed, one team member wondered whether, considering the contradiction in the approved ethics paperwork on this matter, an informal consultation with the chair of the original committee granting approval might allow a simple corrective edit. Another team member stated that a more formal process must be undertaken. Particularly given that this is a nationwide study, and that the incorrect wording had been circulated already and picked up amongst participants, it was ultimately decided (on consultation with managers in one business division) that a memo would be sent to the original ethics committee, which in turn granted formal permission to implement a correction going forward. Because this study is one of a few, at the time of this writing, that are underway across multiple business divisions of Te Pūkenga, our team’s final decision about process could serve as a model for ethics paperwork errors in the future.

It is noted that the errors discussed above may have been identified earlier if the research team had conducted a pilot study. One of the main functions of a pilot study is to gain insights into whether a survey instrument is fit for

purpose or where a research project may fail (van Teijlingen & Vanora, 2002). Although our survey is fit for purpose, if we had conducted a pilot with a small sample of kaimahi in various roles, then we may have identified errors earlier, which would have led to more robust data and saved the time involved in separating the merged data into their appropriate response categories.

## WHERE TO FROM HERE?

At the time of revising this article (July 2023), our surveys have been distributed at 14 business division of Te Pūkenga and, to date, 184 rainbow ākonga plus 228 kaimahi and heterosexual/cisnormative ākonga have completed the surveys. We have secured ethics approval to distribute the surveys in 15 business divisions. Ideally, given that the macro structure of Te Pūkenga is currently being cemented, then micro-level processes that impact heavily on researchers, such as the need to gather approval from 15 ethics committees, may soon be streamlined. This would be ideal given the time involved in these applications.

In working collaboratively to distribute the surveys, the research team is enhancing the research-process knowledge of the emerging researchers on the team. Our research team is comprised of emerging and more experienced researchers, which enhances the advantages of team-based research work, such as the ability to draw on the strengths of each member's personality, background experiences and areas of research expertise (Mcclunie-Trust et al., 2022). Ideally, while the research knowledge of the emergent researchers on our team grows, our experienced researchers will simultaneously benefit from those employed in Rainbow group facilitation and ākonga support.

As the research team members are either members of the Rainbow community, have children who are members of the Rainbow community, or are supportive allies, we have a vested interest in ensuring Rainbow ākonga are safe and included at Te Pūkenga. To this end, the data collection will identify what is currently working well for Rainbow ākonga, and indicate areas/environments in need of improvement. When it comes to the safety and inclusion of Rainbow ākonga, Te Pūkenga business divisions are likely to vary in their institutional policies, provisions and campus climates. The ultimate aim of our project is to support Te Pūkenga's Rainbow ākonga to be welcomed and affirmed. We hope that our own research process and mutual growth can serve as something of a model for how to work through and implement best practices.

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# Key Factors for Selecting Aotearoa New Zealand Tertiary Education Providers: International Students' Perspectives

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## Brief Research Report



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## ABSTRACT

The international education sector brings significant economic and human resource benefits to Aotearoa New Zealand. However, with changes to government immigration settings, overall international student numbers have started to wane since 2018, notwithstanding the effects of the Covid-19 pandemic since early 2020. The challenge for tertiary education providers is to develop improved positioning strategies to attract international students, irrespective of the more rigorous immigration settings. The aim of this study is to explore the key drivers affecting international students' choices of overseas study destination. Primary research by means of an online survey undertaken in mid-2019 sampled prospective international students (n = 296) deciding on a study destination based on a range of factors relating to the choice of tertiary education provision. The findings show that important factors for international students selecting Aotearoa New Zealand as an overseas study destination were "natural environment", "safety" and "lifestyle", while factors relating to the selection of tertiary education institutions were "location", "good graduate employment rate", "good academic reputation", "qualifications are well recognised by employers" and "internship and career support". The study results provide directions for tertiary education providers (universities, Te Pūkenga, PTEs) to develop improved positioning strategies for the international tertiary education marketplace.

## KEYWORDS

Tertiary education, study abroad, international students, international education

## INTRODUCTION

### International education and Aotearoa New Zealand

International education generally refers to the mobility of learners who choose to study in an educational institution in countries other than their home countries (Altbach & Knight, 2007; de Wit & Altbach, 2021). Globally, international student numbers quadrupled to five million from 1990 to 2014, and are estimated to reach eight million by 2025 (OECD, 2018). The international education sector provides significant economic benefits as well as contributing to improved cultural diversity, and academic collaboration in both countries of origin and destination (Tight, 2022). In short, international education supports the process of internationalisation and globalisation.

New Zealand was ranked the top study abroad destination in the Top 10 Study Abroad Countries in the World (educations.com, 2022), and ranked third in the Worldwide Educating for the Future Index 2019 (*The Economist*, 2019). New Zealand has the second-highest international student ratio of tertiary education among OECD countries (OECD, 2018; 2022). In 2018, more than 120,000 international students contributed approximately \$5.1 billion NZD to the New Zealand economy and supported 33,000 jobs (educations.com, 2022). There are three types of educational establishments providing educational services at the tertiary level – universities, institutes of technology and polytechnics (ITPs) and private training establishments (PTEs).



## Current issues of the international education sector in New Zealand

Over recent decades, the New Zealand education industry has experienced growth because of its excellent education reputation and friendly immigration policies. The current challenge facing the New Zealand international education sector is sustaining the growth of international student numbers. In 2017, enrolment numbers for international students declined, as a result of two factors: first, the uncertainties created by the government's changes to immigration rules; and second, intense competition from other countries, such as the United Kingdom, Australia, and the emerging overseas study destination countries in Asia (de Wit & Altbach, 2021; Doyle et al., 2020). Therefore, in a context of tightening immigration policy and fierce international competition, tertiary education providers were faced with the challenges of attracting international students.

The Covid-19 pandemic further exacerbated declining student numbers between 2020 and 2022 when New Zealand closed its borders. While these challenges have had an adverse effect for the New Zealand tertiary sector as a whole, the private training establishment (PTE) segment in particular has been more severely impacted, as this segment is more dependent on international student enrolments.

## Research aim and objectives

Extant literature identifies a number of studies reporting on the motivation of international students to undertake tertiary studies in the USA, United Kingdom and Australia (Anderson, 2007; Binsardi & Ekwulugo, 2003; Tight, 2022). The international student segment is a dynamic marketplace, hence updated market information is necessary to generate accurate market insights for this evolving sector. We posit that adding more information for the context of New Zealand adds to the knowledge base, to enable New Zealand tertiary providers to compete with other major international destination countries (Doyle et al., 2020). To bridge this knowledge gap, this study aims to evaluate the key factors international students consider when selecting a tertiary institution for their international study experience. This study aims to identify key factors driving students' selection of (a) New Zealand as a study destination for tertiary study, and (b) the specific institution for their tertiary study.

## LITERATURE REVIEW

Previous studies have presented a 'push and pull' conceptualisation of migration of populations across countries (Chang & Chou, 2021; Lee, 1966). 'Push' factors are those that motivate people to move out of a country of origin, while, 'pull' factors are those that attract people to the country of destination. The 'push-pull' conceptualisation has been widely applied in different contexts relating to the mobilisation of people, such as consumer behaviour in tourism (Prayag & Ryan, 2011) and international education (Hailat et al., 2022; Mazzarol, 1998; Mazzarol et al., 1996; Mazzarol & Soutar, 2002). These latter studies conceptualised the international student consumer decision-making process into three phases, namely: deciding to study overseas, deciding overseas study destination country and deciding study destination institution.

Studies on the influence of country image for selection of overseas study destination found that country image was a crucial factor in the early stages of consumer decision-making for selection of the host country (Hendriana et al., 2023; Srikatanyoo & Gnoth, 2002). Another study on international-study destination selection showed that lifestyle, cost of living, safety and overall quality of education were relevant variables for consideration (Findlay et al., 2017; Shanka et al., 2006). The studies on aspects of country image as critical drivers of international students' decision-making process showed economic, political and social situations, and the natural environment were important factors at the country level for international students' decisions to study abroad (Cubillo et al., 2006; Hendriana et al., 2023). Perkins and Neumayer's study (2014) on the drivers of the mobility of international students concluded that the number of top-ranking universities in the country, colonial links, GDP and the democracy situation were key drivers for pulling students into a host country.

After selecting a host-country study destination, the decision-making switches to focus on the selection of study institution and programme (Mazzarol & Soutar, 2002). The study institution is a multi-dimensional variable comprising factors such as reputation of education quality, campus and facilities, tuition fees, location, institution or programme ranking, number of international students, number of students from home country and subject availability (Daily et al., 2008; Marjanović & Križman Pavlović, 2018; Mazzarol & Soutar, 2002). Apart from these factors, international students' decision-making was also influenced by word-of-mouth and reputational variables. Mazzarol and Soutar's study (2002) indicates that family members were more influential than education agents. This study also showed promotional advertising and marketing activities by the tertiary institutions served to attract international students' (Binsardi & Ekwulugo, 2003; James-MacEachern & Yun, 2017; Mazzarol & Soutar, 2002). Their study concluded that course availability and tuition fees were higher-ranked factors for the selection of study institution. Table 1, below, provides a summary of the key factors influential in the decision to study abroad, as discussed in this section.

Table 1. Factors influencing the decision-making processes of international students.

Citation	Key Factors	Context	Institution Type	Program Level
Mazzarol, Kemp & Savery, 1996	Easy to obtain information about the country Recommendation from my friends/family Low cost of living Low cost of tuition fees Natural environment Safety Qualifications are well recognised by employers	Australia	All types	All levels
Mazzarol, 1998	The reputation of education quality Offers a broad range of courses and programmes Recommendation from agent Number of international students Advertises and promotes itself strongly	Australia, Canada, New Zealand, the UK and USA	All types	All levels
Mazzarol & Soutar, 2002	Campus and facilities Location	Not specific	All types	All levels
Srikatanyoo & Gnoth, 2002	Country's image from media	Not specific	All types	Tertiary education
Soutar & Turner, 2002	Job opportunities Internship and career support	Australia	University	Undergraduates
Binsardi & Ekwulugo, 2003	Qualifications are well recognised by other institutions Exchange or pathway to other institutions Good graduate-employment rates Part-time work rights during study Scholarship Possibility of immigration Flexible admission criteria and easy admission process Qualification helps with my immigration plan	UK	University and college	Tertiary education
Douglass, 2016	Institution ranking Specific programme/subject ranking	Not specific	University	Tertiary education
Tran & Pham, 2015	Lifestyle Culturally similar to my origin country	Australia	Vocational colleges	Tertiary education
Marjanović & Križman Pavlović, 2018	Flexible intake dates Overseas exchange possibility Short time to finish	Not specific	All types	Tertiary education

## METHODS

A questionnaire based on previous studies (Anderson, 2007; Daily et al., 2010; Gbollie & Gong, 2020; Li et al., 2013; Mazzarol & Soutar, 2002; Shanka et al., 2006) was adopted for our study context. The questionnaire was sent to both New Zealand onshore tertiary students and offshore students who had decided to study in tertiary programmes here (Daily et al., 2008; 2010). The survey questionnaire comprised four sections:

- Section 1: Demographic information
- Section 2: General study situation
- Section 3: Rating of factors for country selection
- Section 4: Rating of factors for institution selection

Sections 3 and 4 were designed to gather participants' perceptions of the importance levels of the factors for destination country and study institution. There were 14 factors in Section 3, and 25 factors in Section 4. A total of 39 factors were identified for the three stages of the study abroad decision-making process, representing the before study, during study and after study phases of decision making.

Participants were asked to rate each factor using a Likert scale of one ("Not important at all") to seven ("Extremely important") for each of the 39 factors (Dawes, 2008; Huang et al., 2023; Linacre, 2002). The questionnaire was administered on Qualtrics. Emails were sent to education agents New Zealand to send the survey links to potential participants. Data collection occurred over a two-week period, yielding a total sample size of 296. Raw data was downloaded from Qualtrics in CSV format. The data was analysed in Microsoft Excel and the results were ranked in order of participant perceptions of importance in terms of the key factors for study abroad decision-making. Ethics approval for the study was obtained from Otago Polytechnic's Auckland International Campus ethics committee (ref: AIC19-11/7/19).

## RESULTS

We report our findings of the data analysis for the context of the two research objectives. Table 2 presents a summary for findings for the first research objective: identifying the ranking of factors that support student choice of New Zealand as a study destination. From the overall mean ranking column in Table 2, the top three ranked factors of "Natural environment", "Safety" and "Lifestyle" are pull factors for students to choose New Zealand as their study destination. The rankings for these three factors demonstrate similar means across different age bands, as well for the levels of programmes, as reflected in Table 2.

Table 2. Factors rankings for New Zealand as a study destination.

Rank	Factors	Overall	18–24	25–34	35–44	Lvls 4–6	Fndtn	Undgrd	PG
1	Natural environment	5.92	5.98	5.67	6.17	6.25	6.11	5.67	5.75
2	Safety	5.63	5.78	5.27	5.71	5.9	5.89	5.68	5.17
3	Lifestyle	5.24	5.28	5	5.79	5.24	5.28	5.2	5.17
4	The reputation of education quality	5.06	5.48	4.32	4.92	5.25	5.42	5.32	4.32
5	Possibility of immigration	5.05	4.92	5.24	5.71	5.36	4.62	4.8	5.27

6	Country's image from media	4.94	4.97	4.71	5.25	5.44	4.77	4.74	4.83
7	Job opportunities	4.76	4.96	4.35	4.96	5.22	4.66	4.84	4.4
8	Good impression from previous travel	4.67	4.65	4.59	5.13	4.59	4.96	4.49	4.61
9	Attracted by specific institution/programme	4.55	4.84	3.94	4.54	5.15	4.72	4.79	3.74
10	Part-time work rights during study	4.49	4.65	3.99	5.21	5.51	4.15	4.44	4.01
11	Easy to obtain information about the country	4.28	4.5	3.72	4.67	4.97	4.32	4.25	3.73
12	Low cost of living	3.4	3.65	3.12	3.67	3.51	3.62	3.48	3.38
13	Low cost of tuition fee	3.4	3.59	3.16	3.88	3.39	3.68	3.38	3.51
14	Culturally similar to my origin country	2.86	2.96	2.6	3.17	3.32	2.85	2.7	2.75

The mid-order means rankings indicate education quality, immigration and job opportunities as key considerations for choosing New Zealand as a study destination. The 18–24 age group shows the highest means ratings for education quality in comparison to other age groups. For younger students, academic quality was a key driver when selecting study destination country. For the 25–34 and 35–44 age groups, immigration appeared to be an important factor in comparison to the younger age group. The mid-ranked factors also show that part-time work rights were an important consideration for the 35–44 age group. These findings also show that cost of living, tuition fees and cultural similarity to country of origin were lower-ranked factors, which appear consistent across age groups.

Table 3 reports findings for the data analysis for the second research objective: identifying factors that drive students' choice of specific tertiary institution. The six highest-ranked factors from the list of 25 factors in the survey in our study were location, graduate employment rate, academic reputation, qualification recognition by employers, career-development support and qualification recognition by other institutions. The mean ratings for the first six factors appeared higher for the 18–24 age group. The middle-ranked factors suggest tertiary institution rankings, short time to finish a study programme, flexible enrolment and support with immigration process are considerations when selecting a tertiary institution. These mid-ranked factors appeared more relevant for mature students who were returning to tertiary study and who seemed to select programmes using pragmatic rationales in their decision-making processes. The tuition-fee factor was the lowest-ranked factor when selecting a tertiary institution. In selecting a tertiary institution, international students indicated that agent and family recommendations were moderately important considerations for selecting a specific institution.

Table 3: Ranking of factors for selecting a tertiary education institution.

Rank	Factors	Overall	18–24	25–34	35–44	Lvls 4–6	Fndtn	Undgrd	PG
1	Location	4.77	4.85	4.42	5.25	5.22	4.85	4.64	4.62
2	Good graduate employment rate	4.57	4.93	4.04	4.08	5.07	4.91	4.83	3.74
3	Good academic reputation	4.52	4.98	3.76	3.79	4.93	5.04	4.93	3.25
4	Qualifications are well recognised by employers	4.42	4.71	4.07	3.75	4.93	4.47	4.7	3.82
5	Internship and career support	4.38	4.73	3.82	4.08	4.78	4.25	4.68	3.78
6	Qualifications are well recognised by other institutions	4.36	4.74	3.69	4	4.81	4.66	4.63	3.48
7	Campus and facilities	4.34	4.72	3.66	4.08	4.64	4.7	4.58	3.6
8	High ranking of the institution	4.24	4.53	3.66	4.29	4.69	4.91	4.21	3.42
9	High ranking of specific study programme	4.2	4.62	3.48	4	4.66	4.98	4.3	3.22
10	Offers a broad range of programmes and courses	4.08	4.54	3.35	3.54	4.34	4.43	4.43	3.25
11	Help with my immigration plan	4.03	4.01	3.95	4.58	4.15	4	3.74	4.06
12	Short time to finish	4.01	3.8	4.14	4.79	4.61	3.83	3.38	4.34
13	Recommendation from my agent	3.77	3.73	3.6	4.29	4.31	3.98	3.22	3.66
14	Flexible intake dates	3.71	3.77	3.61	3.96	4.54	3.7	3.35	3.56
15	Number of international students	3.68	4.03	3.05	3.38	4.1	4.32	3.4	3.12
16	Flexible admission criteria and easy application process	3.63	3.64	3.45	4.29	3.92	3.66	3.62	3.53
17	Exchange or pathway to other institutions	3.6	3.95	2.91	3.67	3.97	4.11	3.68	2.73
18	Recommendation from my family	3.56	4.12	2.66	2.75	3.73	4.09	3.98	2.61
19	Advertises and promotes itself strongly	3.49	3.89	2.78	3.21	3.97	3.6	3.68	2.78
20	Overseas exchange possibility	3.45	3.78	2.85	3.13	4.05	3.47	3.63	2.62

21	Recommendation from my friends/peers	3.33	3.47	3.15	3.4	3.75	3.42	3.27	2.99
22	Getting a scholarship	3.2	3.55	2.54	2.92	3.25	3.6	3.3	2.62
23	Number of students from home country	3.03	3.24	2.51	3.25	2.98	3.26	2.96	2.83
24	Direct co-operation from previous institution	3	3.35	2.31	3.8	3.15	3.57	3.02	2.19
25	Low tuition fees	2.93	2.93	2.96	2.96	2.75	2.94	2.91	3.06

## DISCUSSION

### Why do students choose New Zealand as a destination for tertiary study?

Generally, the most critical factors driving students selecting New Zealand as a study destination were the natural environment, safety, lifestyle, reputation of educational quality and possibility of immigration. These factors fit into the variable of good country image mentioned in earlier studies (Cubillo et al., 2006; Hendriana et al., 2023; Shanka et al., 2006).

The results in our study reflect the findings of previous studies (Cubillo et al., 2006; Shanka et al., 2006); however, there are small differences with reference to age bands and types of programmes. For example, the younger age band appears to focus on the reputation and educational quality, while the more mature students appear to focus on employment prospects and immigration opportunities.

### How do students choose a specific institution for tertiary study?

For the overall mean rating, the five most important factors driving the international students' selection of a study institution were location, good graduate employment rate, good academic reputation, qualifications are well recognised by employers, and internship and career support. Three of the five factors (good graduate employment rate, qualifications are well recognised by employers and internship and career support) were related to employment prospects. These results align with previous findings indicating that employment prospects represent important drivers in the choice of institution and programme (Marjanović & Križman Pavlović, 2018). The location factor may also be related to employment, as, in most cases, the location of study is also the location where the graduates seek jobs.

The mid-ranked factors suggest shorter completion periods, flexible enrolment and support with the immigration process are factors that are more relevant considerations for mature students. In our findings, the cost factor is almost the lowest ranked for choice of study destination and lowest ranked for choice of tertiary institution. Our findings differ from previous studies (Binsardi & Ekwulugo, 2003; Peng et al., 2000; Qureshi, 1995), in that cost of tuition, financial aid (scholarships) and cost of living were highly rated factors between 1990 and 2000. One interpretation for this difference is that cost-related factors are no longer as critical as they were 20 years ago for international students as cost differences have narrowed down in comparable international study destinations. The number of students from the home country is also rated at a low level of importance, which could also be related to the country selection factor of cultural similarity to a student's origin country, indicating that international students prefer cultural diversity for their overseas study experience.

Our results contrast with Shanka et al. (2006), who claim that cultural similarity to home is one of the key driving factors for study destination selection. There are potential reasons for this difference; one is that the low importance

of cultural similarity is in line with the high importance of pursuing a change of lifestyle. Another perspective to explain this difference is that international students seek cultural diversity and an inclusive cultural environment for their study experiences (Doyle et al., 2020; Hung, 2021). Lastly, our findings show that recommendation by an agent is important, even though this factor has received less attention in the past (Ahmad et al., 2016; Mazzarol & Soutar, 2002; Zhang et al., 2023).

### Recommendations for tertiary education providers

From a country perspective, international students appear to value New Zealand's natural environment, safety and lifestyle considerations. Communication of these factors in a positioning strategy provides a 'pull' for international students considering country destinations. To attract more international students, tertiary institutions could focus on four areas: good recognition of qualifications, institution's ranking, employment support and location. With respect to rankings and quality of qualifications, established tertiary institutions such as universities may have 'first-mover' advantages, as they have longer- and better-established rankings. However, other newcomer providers like ITPs and PTEs can compete in this category by communicating other competitive advantages, such as their quality of qualifications – for example NZQA certification – learner support systems and personalised learning. The silver lining of the competitive marketplace for international students is that it is large and growing, which means a range of tertiary providers can tap into the market by applying positioning strategies to create customer value for specific segments of the international student market. While some tertiary institutions have the natural advantage of location, it is suggested that, with marketing promotions, tertiary institutions in less-well-known locations can communicate the benefits of these places as a competitive point of difference to attract international students.



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# AI Design Issues in Education

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Essay



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## ABSTRACT

Toi Ohomai | Te Pūkenga engaged artificial intelligence (AI) developers in mid-2021 to help kaiako (teachers) convert existing subject content into self-generating adaptive learning material. The AI-generated content helped students learn at their individual levels and paces. Feedback highlighted improved student comprehension, and time savings and positive professional development for kaiako. However, considerations in the design and use of AI requires clarity about the range of open risks, exploitative processes in data extraction and training, and how these applications can encode bias and impact Indigenous and creator rights. This essay is an introduction to unresolved issues in AI design, and for decision makers to consider three key questions when choosing or using AI: how the application is built; who owns the knowledge created; and whose values shaped the training data and application design. Responsible use of AI requires very considered and transparent selection of any training data and model development, even prior to designing the AI application that is built on the model. Importantly, companies designing or deploying AI applications in Aotearoa New Zealand need to consider the Waitangi Tribunal recommendations for practical changes to the law, to include consent and protection for taonga and mātauranga Māori, to protect Māori cultural works, language, arts and heritage against unauthorised access or use.

## KEYWORDS

AI design, training data, AI in education, adaptive learning material

## INTRODUCTION

“In the age of big data, data itself has become the raw material of production and a new source of immense social and economic value” (Sterling et al., 2021, p. 3).

In mid-2021 Toi Ohomai Institute of Technology engaged with an Australian-based AI company to alleviate some of the workload for kaiako (teachers) that an increase in blended learning was requiring. Following a pilot and based on student feedback, the application was licensed from February 2022 for a variety of programmes across three faculties at Toi Ohomai. Kaiako uploaded existing text-based course content and slides saved to PDF to be converted into self-generating adaptive learning material, visible only to their students, such as flashcards and quiz questions that self-mark. A web interface with individual logins for students and kaiako presented content for the students and progression reports for kaiako. The application used natural language processing to both generate and grade educational questions to help students learn at their individual levels and paces. The generated content provides a student experience that varies based on individual understanding of the material.

## STUDENT SURVEY FINDINGS, OBSERVATIONS, AND FEEDBACK FROM KAIAKO

Anonymous online student surveys were undertaken to assess the effectiveness of the application. In a survey conducted with nursing students in 2021, 86% of respondents said the AI tool, with individualised training on knowledge gaps and formative checks, was useful in preparing for their tests. Follow-up surveys with students in other courses in 2022 confirmed student enthusiasm for the AI-generated slide and quiz content formats. Figure 1 shows the results from student surveys.

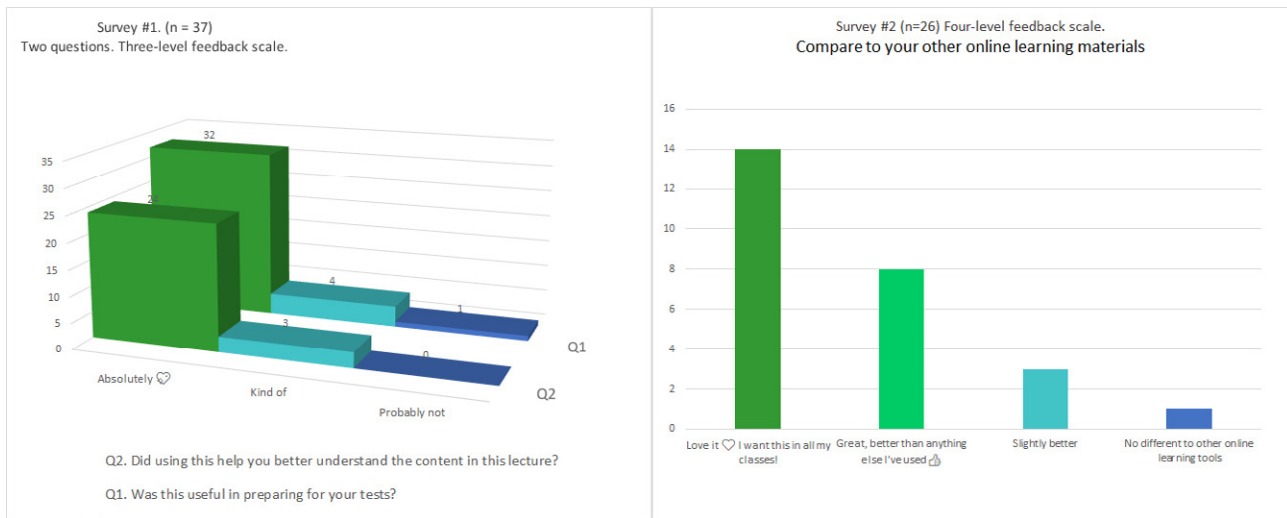


Figure 1. Results from student surveys.

In addition to student surveys, observations were made by the author and feedback gathered directly from kaiako highlighted a number of key benefits from the use of AI-generated content being used in tandem with existing course material. The benefits for teachers included:

1. Course content was interactive, with formative quizzes and flashcards based on each week's work.
2. Better student understanding and retention of lesson content.
3. Positive professional development for staff in relation to AI.

Kaiako commented that they spent less time generating course content, which gave them more scope to focus on teaching or enhancing the quality of courses. The AI tool allowed students' learning progression to be automated in a manageable digital format that was unique to each student. Specific-use AI applications such as this retain the human element where the kaiako curates and is accountable for content, compared with a student using a prompt-based AI tool directly to generate their own formative tests. This approach places the kaiako between the application and student, with the kaiako as the guide.

## KEY ISSUES FOR EDUCATORS

Alongside the benefits, a decision to use an emerging technology such as AI in education also requires software vendors, institutions and educators to be clear about AI design issues and risks, and how these applications can impact Indigenous and creator rights. There are a number of pressing issues as they relate to Aotearoa New Zealand education, as well as principles in AI design where "laws and norms ha[ve] not caught up with AI's unique risks or society's needs" (Microsoft, 2022a). This essay is an introduction to these wider unresolved issues in AI design, to inform decision makers in tertiary education, and are not about any particular application.

Awareness of AI capability has grown exponentially following the November 2022 release of ChatGPT by OpenAI. This has spurred further interest in the vocational education sector in how AI applications can work with humans in a non-programmatic way. Based on our experiences since 2021, and the increase of available AI applications, we have identified three key questions to be considered in using AI within education and more broadly:

1. How has an application been built, or what is the provenance of the application?
2. Who owns the knowledge that is being created?
3. Whose values shaped the design of the AI application?

The development of consumer AI-powered generative art apps, and the training databases that sit behind them, provide a useful case for considering these questions due to their visibility and the public discussion on their impacts (Williams, 2023). These generative art apps are possible with automation enabled by web crawlers built on platforms such as Microsoft Azure and Amazon AWS, to create the datasets of image-text labels needed to train models, to then deliver meaningful outputs (Bindal, 2022). While derived works such as generative art or portrait applications may appear innovative, the creation of these products involves the scanning and analysis of original creative works that are publicly accessible, but not necessarily in the public domain.

Implications for rights and interests that arise within copyright law, the Wai 262 claim, and trade treaties need urgent consideration. Allowing developers to deploy software without accountability risks technological lock-in (Héder, 2021), lending preference to speed over what is equitable, and without consideration of wider social consequences shaping society.

The final area of concern is the training for machine learning and development of predictive models. Briefly, there are two main AI data-training methods: (1) unsupervised or self-learning, such as clustering objects with similar characteristics; (2) supervised machine learning, with regression, and classification where humans are included, labelling features in training data that are then used to predict labels for new items.

Demand for specialised and more accurate models has spawned a gig-economy workforce of millions of contractors who are hired for tagging or categorising content to build the value of training data and their models (Appen, n.d.; TELUS International, n.d.). If trainers are not aware of a diversity of cultural values, or if they lack sensitivity to labels, this can result in default machine learning models that are not appropriate when deployed in different contexts.

An early and influential example was ImageNet database (<https://image-net.org/>), which hosted images of real people with offensive labels for more than a decade (Denton et al., 2021; Gershgorin, 2017). Exploration of this issue was covered critically (Crawford & Paglen, 2019), prompting the question of why classification of humans and their attributes should even be codified. Crawford and Paglen (2019) were then challenged (Lyons, 2020) on informed consent for the use of images for public exhibitions used to raise awareness of the topic, helpfully affirming the non-negotiability of informed consent when using human data.

## GENERATIVE DESIGN: JUST LOOKING, THANKS

A recent example of the continuing gap between creator rights and controls on image processing impacting artists (Williams, 2022), is the Lensa app from Prisma Labs generating personalised portraits in different artistic styles (Prisma Labs, n.d.). The image-text database Lensa was trained on was a copy of the Stable Diffusion model. Stable Diffusion was itself trained on images from another dataset called LAION-5B, “which scraped non-curated image-text-pairs from the internet” (StabilityAI, 2023). The process of unsupervised ‘training’ or ‘self-learning’ includes computing similarity scores between pictures and texts, which means the images are being used and then “subsequently discarded” in a non-expressive use. Differences in copyright regulatory frameworks between EU and the US drive developers to publish methods “to undermine the restrictive and anachronistic EU copyright laws and pave the way for a Fair Use” (Schäfer, 2016, p. 4503). LAION.AI, based in Germany, distances itself from the ‘copying’ of images, but has released its download tool (img2dataset) on its website (Beaumont, 2022). The img2dataset tool “allows downloading 100 million images from our list of URLs in 20 hours with the URL included” (LAION, n.d.).

Stable Diffusion includes ‘Use Restrictions’ in downstream versions, such as Lensa. For example, users are “not to use the Model or Derivatives of the Model: – In any way that violates any applicable national, federal, state, local or international law or regulation” (Rombach et al., 2022, p. 5). Copyright (CC4) is then being applied by app developers on applications built on models that used images trained from LAION-5B and Stable Diffusion.

A lineage of the use of creators’ works and copyright implications are as listed:

- Artist or photographer
- LAION-5B



- Stable Diffusion
- Prisma Labs
- Lensa App
- Consumer

In summary, companies developing AI applications, including LAION.AI researchers, have not addressed the difference between online availability and works being in the public domain.

Accountability for use is already being tested by copyright owners such as Getty, who in January 2023 launched legal proceedings in London against Stability.ai (*Business Insider*, 2023; Getty Images, 2023). This serves as a reminder that, even for research, while it may be possible to use a crawler on the internet to train AI models for a non-expressive use, it may not be legal. LAION.AI operates as a charity, promoting itself as “Truly open AI. 100% non-profit. 100% free” (Beaumont, 2022) but is supported financially by commercial AI companies such as Huggingface.co and Stability.ai, each with over \$1 billion in valuations (Crunchbase, n.d.a; n.d.b). Justifying this open access as research and using the rhetoric of ‘democratising AI’ (LAION, n.d.) ignores Indigenous rights, creative rights and data sovereignty, and is at odds with CARE principles for Indigenous communities to realise opportunities within the knowledge economy for their collective benefit (Carroll et al., 2020).

This is not constrained to images but also text-based works. In the US, more than 8000 authors are calling on OpenAI, Alphabet (Google), Meta (Facebook), Stability AI, IBM and Microsoft to obtain consent, and credit and fairly compensate writers for the use of copyrighted materials in training AI (Fung, 2023). In Australia, developers could be facing liability, as “In general, a person or organisation can rely on a fair dealing exception only for their own use of copyright material” (Australian Copyright Council, 2020, p. 2). There has also been strong push-back from some artists wanting to opt out or reassert their rights (Williams, 2023). In Aotearoa New Zealand, software vendors that rely on the premise that there is no ‘copy’ occurring need to consider the “independent economic significance” (Copyright Licensing Limited, 2020, p. 1) that results when “transient” scanning occurs, referred to in the Copyright Act 1994 s43A, when creating the text and image pairs for training AI models.

## AN AOTEAROA NEW ZEALAND MODEL FOR FAIR USE

Deloitte Access Economics was commissioned by Google (Deloitte, 2018) to analyse the economic impact of introducing fair use in Aotearoa New Zealand. They reported that artificial intelligence methods to train algorithms with large amounts of data that are permissible in the US are not permitted in Aotearoa. Currently, a funding model is being established for supporting creators of artistic works when resold on the secondary art market. This funding model is aligned with the Aotearoa New Zealand Free Trade Agreement with the EU and UK, and allows for 5% of royalties for artists in downstream sales of their work. It is designed to support sustainable careers through ongoing royalty payments. According to the New Zealand Government, this new scheme, jointly announced by the then deputy Prime Minister, is “about fairness ... honouring the tremendous artistic skill and creativity of so many of our visual artists” (Sepuloni & O’Connor, 2022, para. 2). However, there is no mention of any effect this may have for artists whose works were used to train other digital art, generated by AI, illustrating how the law continues to lag behind the pace of technology advances.

Accepting that data from a Western perspective is a property and a commodity in Aotearoa New Zealand means accepting the principles of Te Tiriti o Waitangi are also applicable to Māori data (Taiuru, 2020). This only partially answers the question of ‘Who owns the knowledge?’, as it is relevant for everyone. The justification of fair use of publicly accessible content for research and AI training, without informed consent or compensation, is not accepted when that research is commercialised (Fung, 2023).

Anyone designing or deploying AI applications should consider the Waitangi Tribunal recommendations in the WAI 262 report, for practical changes to the law to include consent and protection of taonga and mātauranga Māori to protect Māori cultural works, language, arts and heritage from unauthorised use. They should also align to plans

(Open Government Partnership New Zealand, 2022) to embed the Algorithm Charter across government data-management practice (Commitment 8). Many IP laws have provision for Māori Advisory Committees and there is also significant guidance on cultural sensitivity within the New Zealand Intellectual Property Office (New Zealand Intellectual Property Office, n.d.).

Evidence of content that has been indexed and therefore used for AI model training is easily searchable in online developer databases that show many images and cultural artefacts from Aotearoa New Zealand with 'All Rights Reserved' or potentially in breach of copyright and use.

Delays in implementing protections recommended by the Waitangi Tribunal more than ten years ago have allowed continued exploitation by developers of images for commercial gain that should have been prevented well before 2023. Examples include filters in Snapchat using Māori cultural imagery that did not have clearance or approval to be used (Brown, 2022; RNZ, 2022). An absence of the enforcement of Treaty Article II protections highlights the gap with mature social media platforms such as Meta in providing attribution features. The tools available in Facebook and Instagram provide a free 'Rights Manager for Images', which uses image matching technology, along with an IP reporting system (Axelgard, 2020). The failure in the Meta design is putting the onus on the infringed to manually report issues.

## EXACERBATING SOCIETAL BIASES – WHOSE VALUES ARE WE USING?

Another key issue with image use is the potential for harm from the mass automated tagging of images or unsupervised learning, which encodes existing biases of an unmoderated internet. These datasets are being built on non-curated images scraped from the internet for 'research purposes', which in their disclaimers highlight the potential for harmful content. This is the same for language models, which when "trained on large, un-curated, static datasets from the Web encode hegemonic views that are harmful to marginalised populations" (Bender et al., 2021, p. 615). This is an issue widely accepted by both developers, as stated in their licenses, and researchers. The image word cloud in Figure 2 shows the range of 'potential' Not Safe for Work (NSFW) image-text labels using English text in the LAION-5B database, even before any cultural or contextual issues are identified. Subsets of these databases can be curated to provide 'aesthetic' content, but this leaves open the ability to vary the weightings that include or exclude content. Decisions about what is suitable or 'aesthetic' are made by developers "in a scale from 0 to 10 to be good looking or not" (LAION-AI, 2022).

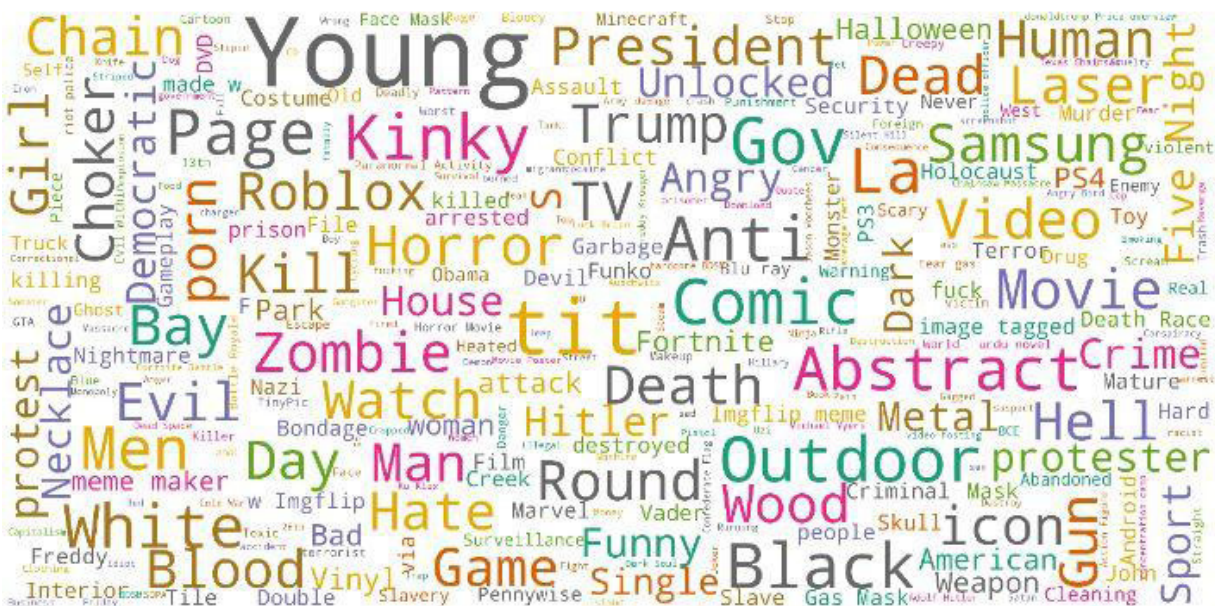


Figure 2. Word Cloud published to illustrate range of identified potentially inappropriate concepts or NSFW content (Schuhmann et al. 2022, p. 33. CC BY 4.0, <https://creativecommons.org/licenses/by/4.0/>).

While Prisma launched a business-to-consumer app on the backs of artists' styles, other companies are building private datasets using human trainers. The issue here is opaqueness, the varying cultural perspectives of the trainers, and which values are subsequently being fed into the AI models. Companies such as Appen (Australia) (Appen, n.d.) and TELUS International (Canada) (TELUS International, n.d.) recruit contract workers globally on "location-based minimum wage" (Bogle, 2022, para. 26) to work on projects that tag or categorise images, text and video. This human-powered extractive work provides no visibility into the cultural contexts or potential bias that a dispersed and temporary workforce is producing. An industry and process built on casual minimum-wage labour and unsupervised processing of public-domain resources draws an obvious parallel with exploitation of resources in earlier industrial revolutions.

## THE DANGERS OF DEFAULT

The ease and subtlety with which societal biases influence AI, as flagged by the LAION-5B license, is seen in the default Google Cloud Vision labels used when describing an image loaded by the author, shown in Figure 3. The screenshots of results across three different years in Figure 3 show how implicit cultural-bias labels can find their way into any default dataset where tags are applied from humans, or acquired in unsupervised learning. But, unlike humans, nobody is held accountable for perpetuating the bias that can be fed back unnoticed into new applications.

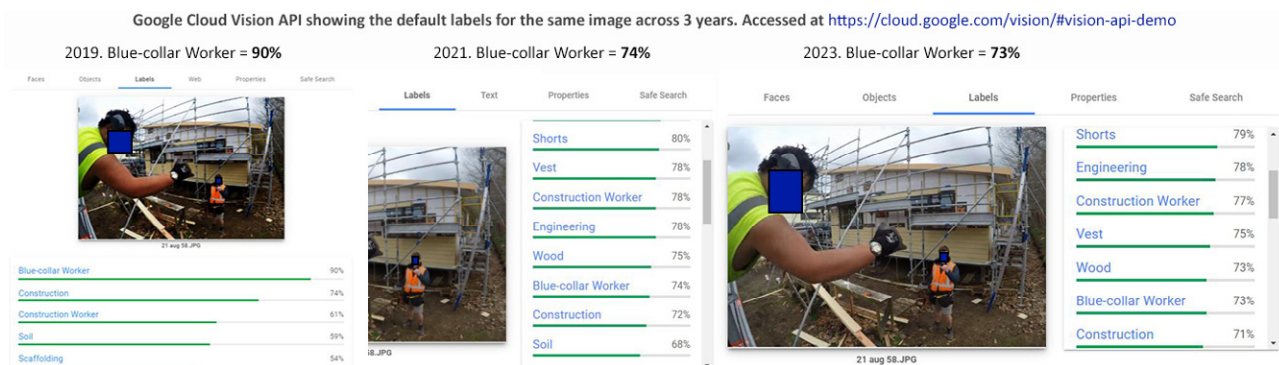


Figure 3. Google Cloud Vision labels (faces obscured for publishing). Image from author, results from <https://cloud.google.com/vision/#vision-api-demo>

The labels in Figure 3 show how weightings change, and also demonstrate how the cultural norms and subjective labels used in one society are not appropriate for another. The phrase "blue-collar worker" comes from historical class hierarchies and occupations, and is a synonym for someone who is not highly educated (Oxford Reference, n.d.), thus perpetuating deficit mindsets. This may be innocuous on its own, but if it influences a credit algorithm rather than retail mall promotion (O'Shea, 2023) then the results could be very consequential for an individual. The use of biometric categorisation or inference of gender, age and mood already used in Aotearoa New Zealand shopping malls would be banned in the proposed EU Artificial Intelligence Act (European Parliament, 2023).

Using a disclaimer to say a service is a demonstration or research service is not enough, there is an absence of cultural context and transparency that is a flag for quality and appropriateness of the service. This example is a symptom of a fundamental AI alignment challenge in "deciding to whom these systems should be aligned" (Leike et al., 2022, para. 5).

## CONCLUSION

AI developers and researchers have devolved responsibility to downstream users within their software licenses. Thus, it is incumbent on all participants to understand the provenance of their applications and verify with suppliers their existing obligations and responsibilities.

Government agencies such as the Ministry of Business, Innovation and Employment and the Ministry of Education as signatories to the Algorithm Charter for Aotearoa New Zealand should be ensuring their vendors and suppliers also commit to the six core principles. These include: 2. “Partnership – Embedding a Te Ao Māori perspective in the development and use of algorithms consistent with the principles of the Treaty of Waitangi” (Stats NZ, 2020, p. 3).

Regulatory clarification is needed for non-expressive uses of data (Deloitte Access Economics, 2018), for data guardianship and excellence (Sambasivan et al., 2021). There are significant opportunities to promote Indigenous innovation and locally developed AI models, alongside wider and earlier participation in AI development (Ministry of Business, Innovation and Employment, 2019).

The inventor of ImageNet, Dr Fei-Fei Li, co-founded a diversity and inclusion initiative for AI more than seven years ago (AI4ALL, n.d.), while Mira Murati, CTO at OpenAI, shared in February 2023 they “need a lot more input that goes beyond the technologies, definitely regulators and governments and everyone else” (Simons, 2023, para. 20). This willingness by AI leaders to create change needs to reflect into continuous, sustained action by counterparts in political and community leadership roles.

Technology companies intending to sell services or deploy products must also consider their jurisdictional liability and the provenance of the AI models to be used in Aotearoa New Zealand. There is “the need to invest significant resources into curating and documenting LM training data” (Bender et al., 2021, p. 615), and disclosure of origin and community support statements (collective consent) (Hudson, 2019). The urgency for transparency and community engagement is driven by the momentum and resources already allocated in commercial and open-source AI development. The scale of AI leaders’ ambitions is illustrated by Stability AI founder Emad Mostaque asking “who’s building the Japan model, or the India model or others? Well, we are” (Guo, 2023, para. 24).

With OpenAI capabilities being released on Microsoft’s Azure (Boyd, 2022) and open-source models on Amazon Web Services (Bathgate, 2023), stakeholders should be actively participating at the design stage, directing design alongside the development community. An example of this gap between users and developers is the requirement for developers to list adverse impacts and identify stakeholders (Microsoft, 2022b). The issue is that developers will be unaware of their unconscious bias, hence the need for stakeholders at the design stage, where “the functional logics of a given technology echo the gender and racial dynamics of the industry that produced it” (West et al., 2019, p. 8).

Public-service procurement advice for Generative AI is to consider vendor reputation and have protections in contracts for privacy, security, ethical risks and vendor lock-in (Department of Internal Affairs, 2023). Tertiary education providers with public funding should preference vendors demonstrating commitment to the *Algorithm charter for Aotearoa New Zealand* (Stats NZ, 2020) and Te Kawa Mataaho Public Service Commission’s plans to further embed transparency and accountability in the use of algorithms with the Open Government Partnership New Zealand (2022). The Education and Training Act 2020 requires tertiary education institutions to recognise and respect the Crown’s responsibility to give effect to Te Tiriti o Waitangi. Schedule 13 contains the Charter requiring Te Pūkenga to reflect Māori–Crown partnerships (New Zealand Government, 2020). A genuine partnership involves respect for Māori aspirations, values and property, accepting that thinking through legal and data provenance issues needs to be part of the design process, not an afterthought.

Taking action does not mean constraining innovation or exploration, but does mean proactively designing for these legal, IP and data sovereignty issues beforehand. The trajectory of AI development discussed by Héder (2021) depends on the actions of society, social context and control, and the social license to operate. Educators cannot be

bystanders “shield[ing] the creators of these systems from accountability while its deterministic, calculative power intensifies social classification and control” (Campolo & Crawford, 2020, p. 1).

The change in relationship required between AI developers, vendors and customers is reflective of the wider societal transformation occurring in Aotearoa New Zealand. As the Waitangi Tribunal has affirmed, our relationships must change “into a twenty-first century relationship of mutual advantage in which, through joint and agreed action, both sides end up better off than they were before they started” (2011, p. 17).

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# Are Tech Companies Dangerously Veering Away from Their Managerial Accountabilities?

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Essay



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## ABSTRACT

A disturbing pattern is emerging on the corporate horizon. At first glance, the tech companies seem to have solutions to every problem. But is that right? What about the Covid-19 pandemic, looming global wars, terrorism and climate change, and other issues such as the growing impact of AI? Tech companies often seem to be operating outside the framework of ethics and managerial decision-making rules, with weak synchronisation between stakeholders, and regulatory systems are not being activated. Social accountabilities are being thrown to the wind, with global implications in our interconnected world. This essay discusses management, and whether tech companies need to be reined in, focusing on media sources reporting on problems of governance by technocrats.

## KEYWORDS

Technocrats, management, social accountabilities, business ethics, governance

## INTRODUCTION

Technological development may be outpacing managerial ability to conduct business within the framework of good governance. Technocrats – leaders of tech companies – are under the illusion of one day having a manager-free organisation, analogous to a pilotless airplane. This is a dangerous and immature philosophy, as organisations are complex and unique entities. Furthermore, pilots may be replaceable with others trained on the same type of aircraft, whereas organisations are rarely alike – finding a substitute manager may not be an easy task. Technocrats are the catalysts who aspire to provide good ethical governance for the organisation, to ensure the right decisions every time. But managers are the soul of an organisation, and their ethical decision-making role cannot be bypassed.

In the words of Burt Huang, a scientist at Tufts University: “My pessimism about the chances that these tools will be built with humans retaining agency comes from the fact that primitive versions of them allowing no human agency are already embedded in our society” (Anderson & Rainie, 2023). The same article quotes a co-founder of an award-winning non-profit network who has expressed concerns about corporations gaining control over workers and consumers, and the negative consequences for democratic societies. There is increasing interest in the ethical implications of algorithms that influence our lives but are not responsible for decision outcomes. For example, a computer system, COMPAS (Correctional Offender Management Profiling for Alternative Sanctions), denied parole to a rehabilitated prisoner; the parole board responsible blamed the error on the system’s algorithms, but the tech company stifled the clarification as it considered the information to be a trade secret (Martin, 2019).

Is there a lurking danger of technology crashing into society’s value systems? Are the technocrats removing the safety switches from organisational functioning? As organisations are rapidly growing, their control systems are being dismantled. When a car speeds up, it requires more efficient braking, not to have its brakes removed, and managers are the brakes of the organisation. Managers are necessary for healthy functioning, and technocrats need to support management systems that regulate the organisation and comply with societal norms. Managers are like the immune system of society: if they become weak, the technocrats will overstep their role, with tools such as AI, ChatGPT and advanced technology at their disposal. There needs to be a licensing system for an algorithms-driven society.

This essay explores and examines the rationale for strengthening the human managerial role. The aim is also to understand how ethical decision-making could lead to better governance and prevent technology-driven management from polarising governance in organisations. The current study would bring synergy between technology and good governance by exploring whether technocrats are bypassing management principles. Is there an urgent need for a new direction to bring technocrat-managed organisations back on the right path? What steps can be taken to strengthen the management process in organisations that have a one-sided focus on technology?

## **THEORETICAL BACKGROUND: ETHICS, DECISION MAKING, TEAMWORK**

One of the key problems is common-sense management. Many erroneously believe technocrat management to be professional management, but this is like saying that a good car makes a good driver. Specialisation leads to better functioning: technocrats should focus on technology while managers focus on professional management. Unfortunately, in many cases a desire for control supported by an inflated ego has encouraged technocrats to throw professional management out of the window. Some management concepts have been particularly vulnerable to this erosion.

The primary concepts necessary for the good governance of an organisation are ethics and social responsibility. Every professional manager is equipped with ethical and social-responsibility tools for maintaining good governance. Ethics are the fundamental moral rules and frameworks around how managers make decisions (Watts, 2019). The world is a global village, but should not be an experimental lab in which rich and famous technocrats try their hand at managerial skills. Someone without a license is not allowed to fly a plane, nor are they allowed to conduct surgery on someone without a proper license and necessary qualifications. By the same logic, it is risky for technocrats without managerial qualifications to be in a management role.

The next relevant concept impacting the management of corporations and society is decision making. There are better decisions and worse decisions, and every professional manager has management-focused decision-making processes. The quality of the decision will determine the outcome for the business and wider society. Technocrats may overrule normal ethical decision-making to achieve their vested goal. For example, tech companies such as Facebook, Google, Instagram, and WhatsApp have been litigated for forcing users to agree to their terms for personal data harvesting (Vinocur, 2019).

Teamwork and control are also relevant concepts, particularly with regard to respecting the interests of all stakeholders. History is full of examples where, due to weak management, tragedy or failure has occurred: the Columbia and Challenger spacecraft tragedies, the Volkswagen emission scandal, the Takata airbag scandal, the Flint water crisis, and many more (Oberkampf, 2018). All these problems had one thing in common: management failures as a significant contributing factor, which may have been the result of management decisions taken by a top-heavy technocrat body. In any entity it is assumed that stakeholders – society, government and management – should work in the common interest. If any of the stakeholders should falter, control mechanisms must exist and be activated: if this does not happen, then the management system needs overhauling. One of the ways to strengthen the management process is by appointing the right people for the right job. If this is not done, then a crisis may be inevitable.

## **CONCERNING TRENDS IN THE TECH SECTOR**

After the recent acquisition of Twitter by Elon Musk, serious charges have been laid by US Democrat Senator Ed Markey. According to Markey, Elon Musk has failed to police disinformation on Twitter. An imposter Eli Lilly account, posing as the pharmaceutical company, announced that insulin would now be free. This fake account was authenticated by Twitter with the blue check mark (Barlow, 2022). Questions are also being raised about Tesla's safety standards. Musk is no doubt a tech-savvy billionaire, but managerial capabilities are not his forte, especially in formal decision-making. This is reinforced by a poll conducted by him in which 17.5 million people voted that he should step down as CEO of Twitter (Race & Kleinman, 2022).

Elon Musk's medical-device company Neuralink is facing a federal probe, with allegations that the company is indulging in animal-welfare violations. Employees have stated that animal testing is being rushed, causing stress, torture and death to animals (Levy, 2022). This reflects a lack of ethical decision-making and flouting of social-responsibility norms, with employees' complaints about animal welfare giving an impression of deficiency in teamwork and control concepts.

The lack of managerial accountability extends not only to Elon Musk's companies but also to other tech-savvy executives. Mark Zuckerberg's Facebook is facing an anti-trust investigation from the Federal Trade Commission and 46 US states, with suggestions that Zuckerberg has been illegally killing competition to maintain a monopoly position. Its acquisitions include Instagram and WhatsApp. Here, again, it appears that the tech-savvy technocrat has gone off tangent when it concerns ethical managerial decision-making (Clayton, 2021). In an interview with a *New York Times* tech columnist, it was mentioned that the big five tech companies are more powerful than many governments. They were described as the "Frightful Five" (Gross, 2017, para. 2).

One of the areas of concern emerging in the era of powerful technological advancement is the right to privacy. Powerful tech companies hinge their success on accessing personal information, raising public debates about protecting society against the ever-expanding eagle eyes of surveillance-savvy tech companies. There is an increasing demand for the "right to be forgotten" (Igo, 2022, para. 5) and the "right to move undetected through public spaces" (Igo, 2022, para. 5) In the past, things that were taken for granted such as privacy are now being viewed as if "everyone is a public figure" (Igo, 2022, para. 16). The tragedy is that these views are the interpretation of the American courts, encouraging tech companies to ignore ethical decision-making within the ambit of societal norms. It shows the systemic change in core democratic thinking versus the 1880s, when the Supreme Court ruled that the right to privacy was significant to individuals' liberty and was deemed a sacred right (Igo, 2022).

## TECH COMPANIES AND GOVERNMENTS

Large tech companies are increasingly imposing their influence on the retail ecosystem, jobs, inequality, and many other areas (Gross, 2017). Around the time of the 2020 US elections, it was believed by some that one of the two main threats to democracy would be from Facebook, with a Democrat strategist considering it to be an immoral company (Scola & Thompson, 2020). This indicates the perception of tech companies in the sphere of ethics and social responsibility, and makes one wonder whether the synergy between the major stakeholders exists only on paper. Democrats, after winning the 2020 elections, have proposed to give a fresh look at tech companies' relationships with their users, with suggestions that this is about settling old scores from Facebook's role in Trump's 2016 victory (Clayton, 2021). Tech companies and governments are on a collision course, and the users, also important stakeholders, are inconveniently entangled between governments and the tech companies.

What is the relationship between governments and the tech giants? There may be conflicts of interest that could hamper the push for an anti-monopoly movement. For example, in the United States the ex-CEO of Google is recommending appointments for the Department of Defence, and two officials of Amazon are in the hot spot in the Office of Management and Budget. Facebook, too, has made noteworthy inroads into the Biden administration (Bose, 2020). In Europe, many tech companies have been fined heavily by the EU under the General Data Protection Regulation (GDPR): Amazon paid the biggest fine of US \$877 million in 2021, for unknown violations related to cookie consent non-compliance (Tessian, 2022). Social media should empower democracy, not undermine it, but companies' track records are found wanting on ethics and accountability. For instance, a United Nations human rights investigation revealed the involvement of Facebook in spreading hate against Rohingya people, sparking riots that forced them to flee Myanmar (WION, 2021). It appears that the technocrats managing the company have become solely profit-centric, throwing their ethics and social responsibility norms to the wind.

In the United Kingdom, *The Telegraph* has reported that the government secretly worked with social media, including AI companies, carrying out surveillance and suppressing criticism during the Covid-19 pandemic (Diver, 2023). Facebook and Twitter gave the government 'trusted flagger' status, defining them as an expert for tracking illegal content online (*Law Insider*, 2023), and the AI firm Logically, which participated in the surveillance, stated

that they flagged posts by distinguished scientists criticising mass vaccination of children. Did tech companies go beyond their ethical boundaries in supporting these moves by the UK Government? This trend warrants strengthening of managerial governance, particularly as similar collusion has also happened between the US government and Twitter (Diver, 2023).

In 2021, *The Washington Post* reported the use of Israeli spyware to carry out surveillance on journalists, businesspeople, and human rights activists around the world. This is a clear misuse of technology to curb freedom of speech, and particularly concerning as the private tech firm involved is a worldwide leader and an unregulated player using military-grade spyware. The technocrats are clearly overstepping their moral, ethical, and legal boundaries (Priest et al., 2021).

Tensions also appear to be brewing in financial privacy. There is a move by the US Government to develop a digital dollar, triggering suspicion of transaction-tracking possibilities. The sceptics are citing China's similar move to deploy the digital yuan, which is being viewed as a financial monitoring tool (Vittorio, 2023), with fear of authorities freezing personal bank accounts for financial or political reasons (Huff, 2023).

## THE GROWING IMPACT OF AI

According to some experts, the rise of artificial intelligence could lead to a fall in morality in human society. According to the host of the popular TV show *Keep the Republic*, the rise of AI is corresponding with a fall in morality (Hughes, 2023). As recently as June 10, 2023, *The New York Times* published an article titled "How Could AI Destroy Humanity?" in which the signals are clear, as 'where there is smoke, there is fire.' Researchers and experts are showing concern that technocrats are making AI systems so autonomous that thinking and decision-making tasks are being delegated to them. This could pave the way for an existential risk for all living beings (Metz, 2023). It is of high urgency that the managerial framework of due diligence is integrated into the tech accountability system as a measure of self-correction.

A top AI researcher resigned from Google over an important ethical issue in 2020 (Waters, 2020), and in May 2023 the 'godfather of AI', Geoffrey Hinton, quit Google so he could speak more freely about his concerns over the rapidly developing technology. Hinton has expressed his fears that the rapid developments in the tech world could lead to AI systems overtaking human intelligence and starting to manipulate humans (Osborne, 2023). A more positive sign has come from tech experts wanting to pause AI tech development because it poses a profound risk for humanity (Metz & Schmidt, 2023), suggesting there is traction building to remain within the sphere of accountability. This can be facilitated with a counterbalancing managerial process incorporating the due-diligence framework within the ambit of ethics, social responsibility and law.

## IMPACTS ON OTHER SECTORS

What is happening in the tech sector is also spinning off to other parts of the world economy. From the managerial point of view, it would be interesting to observe whether the tech companies veering away from accountability are contained within a sector. This observation is relevant, because every managerial decision applies three-way alternative views – the best, the realistic and the avoidable view.

If the technocrats believe in the best view of maximising profits, then long-term sustainability will take a back seat. The realistic and avoidable views will not work for the second layer of management personnel. The long-term impact could be the fallout and shift to maximising goals by other sectors. The power and responsibility sharing between the top layer and second layer of management needs the counterbalance of accountability. If one layer adopts the short-term profit-maximisation goal, there needs to be a countercheck by the other layers below. This could be a realistic or avoidable view of a long-term sustainability approach hinging on teamwork and control mechanisms.



The latest addition to the tech world, which managers from every sector are talking about, is ChatGPT. It will transform life at a higher intensity than anything tech companies have done until now, but is ripe for misuse. Venture capitalists have invested \$1.7 billion in two years in a research lab developing the software OpenAI, and the possibilities are limitless if someone wants to cross the line beyond ethics and social responsibility. For example, a student can pass an MBA exam with the help of this software. These advances will make cheating easy for students, without the fear of getting caught for plagiarism, and disrupt every sector of the world economy positively or negatively. The direct and indirect ramifications for society will be far reaching if it falls into the hands of unethical actors (Firstpost, 2023).

With the events unfolding in the present, the future appears unsettling, with managers facing greater uncertainties and risks. Declining managerial skills are diluting the governance of tech companies, and this mismanagement could be spreading, threatening broader pillars of management principles and good governance. The framework of management needs strengthening if the fruits of technology are to be enjoyed: we can let the tech brain fly in the clouds, provided the non-tech managers keep their feet on the ground.

## CONCLUSION

To summarise, a more cautionary approach is needed. There is no doubt that the tech world is galloping at reckless speed with innovative ideas. The zest and zeal at the surface are camouflaging the profit-focused rationality of the tech specialists, negatively disrupting the balance between the technocrats and managers. If this is allowed to spread to other sectors it could lead to confusion in strategic terms. Technocrats and managers are like two sides of a coin. If technocrats are the brain or body, the managers are the heart or soul and cannot be left behind or pushed into the corner as artefacts of earlier systems and practices. The governance of ethics and social responsibility, decision making, teamwork and control becomes paramount, and it is in the interests of all stakeholders to encourage due diligence by independent management.

Humanity is facing mounting problems, including climate change, wars, pandemics and terrorism. Stepping up the research in this area is needed to put the unnecessary growing problem into proper perspective. There is no point in living under a rock, as time is of the essence. As Elon Musk said, almost ten years ago, "The risk of something seriously dangerous happening [with AI] is in the five-year time frame. Ten years at most" (Rosenfeld, 2014, para 4). Better ethical decision-making processes are needed at the centre of organisation management, to infuse a long-term vision for a better balance between technology and governance.

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# Carbon Emissions and Organisational Performance: Friend or Foe?

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## Research Report



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## ABSTRACT

This research aims to investigate the short-term effect of carbon emissions on financial performance and market value of Aotearoa New Zealand companies. It hypothesises that the direct and indirect carbon emissions negatively affect short-term firm performance. It further posits that the relationship between carbon emission and firm performance is moderated by a firm's leverage. The study sample includes quarterly data of New Zealand listed companies from 2017 to 2021. The study uses univariate and multivariate methods such as correlation and panel regression models to test the hypotheses. The empirical results demonstrate that the impact of direct emissions on performance and market value is significantly negative. There is evidence that high direct carbon emissions reduce firms' return on equity, return on assets and Tobin's Q. Furthermore, the relationship between indirect carbon emissions on performance and market value is insignificant. Since firms are not able to control indirect emissions, these do not directly affect financial performance. The findings indicate that high-debt firms contribute to carbon emissions and decrease both firm performance and market value in the short term. This study is useful to practitioners interested in understanding the impact of carbon emissions on businesses. Additionally, the findings will assist policy makers in formulating carbon-emission policies and disclosures among New Zealand businesses.

## KEYWORDS

Carbon emissions, firm performance, market value, leverage

## INTRODUCTION

Aotearoa New Zealand is one of the countries worldwide that is most concerned with climate change, the environment and reducing greenhouse-gas emissions. In 2019, the New Zealand Government passed the Climate Change Response (Zero Carbon) Amendment Act 2019, intending to set carbon budgets to enable the transition to net-zero carbon by 2050 (Ministry for the Environment, 2020). In the same year, the Ministry of Business, Innovation and Employment (MBIE) launched the Building for Climate Change Programme to reduce building-industry emissions affecting climate change. This programme aims to encourage the industry to reduce carbon emissions through changes to the building code. Although this new legislation and changes in the building code have added to operational costs for most businesses, it is hoped that these will encourage businesses to reduce their carbon emissions. One industry that contributes significantly to New Zealand's carbon emissions is agriculture. Agriculture and farming are New Zealand's largest providers of its gross domestic product; unfortunately, they have also become the most significant contributors to the country's carbon emissions, in relation to other industries. The sectors are responsible for 49% of ANew Zealand's carbon emissions, compared to only 12% for other developed countries (Ministry for the Environment, 2020). From the mid-1990s to 2020, the farming and agricultural sectors have grown and intensified, and this has contributed to the increase in carbon emissions. Nonetheless, the New Zealand Government has imposed several measures to curb the carbon emissions produced by these sectors by imposing a higher tax. Although these industries contribute significantly to New Zealand's carbon emissions, our study focuses on a broader range of sectors. Due to the voluntary nature of reporting, we were unable to obtain substantial data from the farming and agriculture sectors. Hence, we include all companies that report carbon emissions in our analysis. Specifically, we have analysed data from 49 publicly listed firms in New Zealand.

Nevertheless, it is necessary to acknowledge that future research could examine these specific industries to gain valuable insights into New Zealand's emission landscape.

It is not surprising that there is a growing body of environmental literature that has examined the impact of carbon emissions on firms' financial performance. The findings are inconclusive, not only in the extent of the effects but also in the direction (Ganda & Milondzo, 2018; Lee & Cho, 2021; Zhang & Liu, 2019; Zhang & Vigne, 2021). Lee and Cho (2021), in studying the impact of carbon-emission disclosures on firm performance among South Korean companies, have observed a positive correlation between the two variables. This is because of the public's admiration for companies that practice social responsibility. Similarly, Sun et al. (2021) have observed that the carbon-emission trading scheme correlates significantly with the corporate performance of high energy-consuming firms in China. They studied listed Chinese firms from 2010 to 2016. Another study by Zhang and Liu (2019) found that carbon-emission trading negatively affects short-term profits but can increase performance in the long run. In contrast, in studying the cost of carbon emissions, Zhang and Vigne (2021) have found a negative relationship between carbon-emission cost and organisational performance. Due to inconclusive results observed so far, undertaking research focused on investigating the impact of carbon emissions on the financial performance of firms in New Zealand is a valuable initiative to gather more context-specific insights. The study is motivated by New Zealand's vulnerability to climate change, reliance on agriculture economically, renewable energy potential, policy landscape, supply-chain challenges and public perception. We wanted to investigate whether environmentally responsible firms have a competitive advantage that leads to increased profits and market value. Additionally, our research can shed some light on how firms' sustainable practices can reduce emissions while maintaining profitability. The study investigates the effect of carbon emissions intensity (specifically Scope 1 and Scope 2 emissions) on corporate financial performance and market value. A direct emission occurs from sources owned or controlled, and an indirect emission occurs from sources purchased, such as electricity, heat or steam. We measure financial performance through the return on equity (ROE), return on assets (ROA) and Tobin's Q. More specifically, this study addresses the following four research questions:

1. What is the relationship between carbon emissions and a company's return on equity (ROE)?
2. What is the relationship between carbon emissions and a company's return on assets (ROA)?
3. What is the relationship between carbon emissions and a company's Tobin's Q?
4. Does a firm's leverage moderate the relationship between carbon emissions and ROE, ROA and Tobin's Q?

The research contributes to the literature in two ways. First, the literature has provided inconclusive and mixed results when examining the impact of carbon emissions on organisational performance (Lee & Cho, 2021; Sun et al., 2021; Wang et al., 2014; Zhang & Vigne, 2021). The findings of this study will provide some clarity in that regard. This study provides new evidence on the relationship between carbon-emission cost and financial organisational performance, measured by Tobin's Q, ROE and ROA. Furthermore, we collected data from New Zealand companies that have not been examined in the past. Second, the findings of this study will practically shed some light on the importance of reducing carbon emissions in future operations among businesses in New Zealand. Our findings demonstrate positive correlations between sustainability and financial performance that can be used to educate businesses, investors, and the public about environmentally responsible practices.

## LITERATURE REVIEW

### Reasoned action, social identity and stakeholder theories

This study bases its conceptual model on the Theory of Reasoned Action (TRA) (Ajzen, 2011; Ajzen & Fishbein, 1980) and Social Identity Theory (Tajfel, 1972). TRA (Ajzen, 2011; Ajzen & Fishbein, 1980) supports the relationship between values and intent. The theory argues that an immediate determinant of one's behaviour is one's intention to perform that behaviour. Translating this into the organisations that practise an environmental orientation, the ethical values of corporate environmentalism should influence their intention to reduce carbon emissions in



their operation. This theory has also been used to explain a wide range of behaviour toward an environmental orientation, including organic food consumption, dieting and the purchase of environmentally responsible products (Magnusson et al., 2003; Seiwacz et al., 1980).

Tajfel (1972, p. 31) conceptualises social identity as “the individual knowledge that he (or she) belongs to certain groups together with emotional and value significance to him (or her) of the group membership.” The theory suggests that the behavioural outcome of an individual is a result of strong identification with a group to which that individual may want to belong. Consequently, should the organisation establish the norms and culture of reducing carbon emissions, this would attract customers to consume the organisation’s products and services, and vice versa. A stakeholder theory is a view of capitalism that stresses the interconnected relationships between a business and its customers, suppliers, employees, investors, communities, and others who are interested in the organisation (Freeman, 2010). The theory further argues that an organisation must be responsible to all its stakeholders, and not only the investors and shareholders (Freeman, 2010). Translating this theory to this study, it is in the interest of organisations to attempt to reduce carbon emissions. This is because carbon emissions represent cost: the cost to the operation and the cost of losing customers. The literature has observed that today’s customers prefer environmentally responsible organisations (Bui & de Villiers, 2017; Suley & Yuanqiong, 2019; Wisker et al., 2019).

### Linking carbon emissions and organisational performance

The literature has documented two approaches to analysing the effect of carbon emissions on organisational performance (Boiral et al., 2012; Wang et al., 2014). The first approach is win–lose reasoning, and the other is win–win reasoning (Boiral et al., 2012). The win–lose reasoning argues that the effort companies make to reduce their carbon emissions would result in a higher cost that could detract from their competitiveness (Wang et al., 2014). On the other hand, the win–win approach theorises that the companies’ efforts to reduce carbon emissions help improve corporate competitiveness. Our study posits the latter. This study’s framework is also supported by the Theory of Reasoned Action (TRA) (Ajzen, 2011; Ajzen & Fishbein, 1980) and Social Identity Theory (Tajfel, 1972). Carbon emissions increase the operational cost of an organisation (Zhang & Vigne, 2021). This study posits a negative relationship between carbon emissions and organisational performance using social identity (Tajfel, 1972) and reasoned action theories (Ajzen, 2011; Ajzen & Fishbein, 1980). According to the stakeholder theory (Freeman, 2010), the organisation is responsible for its customers, employees, shareholders and investors, suppliers, and the community at large. The top managers need to pay attention to the stakeholders’ interests. The operating expenses to cover the cost of carbon emissions can be detrimental to organisational performance. Therefore, top managers must find ways to reduce carbon emissions. A company’s reputation for environmental responsibility signals long-term benefits to the stakeholders, especially the local community and society. This activity will, in turn, attract more customers to the organisation.

This relationship can be explained further by the theory of social identity, which postulates that the behavioural outcome of identity is the result of strong identification with a group to which that individual may want to belong. The literature has documented how society and the public would prefer environmentally responsible companies (Bui & Villier, 2017; Wisker et al., 2019). Empirical studies have also observed that socially responsible organisations perform well. Bui and Villier (2017) found that the public favours organisations that have great control of their carbon emissions. They further argue that excessive carbon emissions have been identified as a significant threat to sustainability and companies’ survival. Past studies that examined the effect of carbon emissions on organisational performance have also observed a negative relationship (Smale et al., 2006; Wang et al., 2014; Zhang & Vigne, 2021). Smale et al. (2006) observed that European Union countries that have attempted to reduce carbon emissions have experienced a positive impact on earnings before interest, tax depreciation and amortisation. Similarly, Matsumura et al. (2014), and Garzon-Jimenez and Zorio-Grima (2021) have observed that carbon emissions have a negative relationship with the market value of equity. Higher carbon emissions lead to a higher cost of equity, resulting in reduced organisational performance (Garzon-Jimenez & Zorio-Grima, 2021). If reducing carbon emissions results in an increase in financial performance, it is clear that an increase in carbon emissions would reduce organisational performance.

Summarising the discussion thus far, this study posits a negative relationship between carbon emissions and organisational performance; therefore, the following are hypothesised:

H1: There is a negative relationship between direct carbon emissions and a company's ROE, and this relationship is moderated by the company's leverage.

H2: There is a negative relationship between direct carbon emissions and a company's ROA, and this relationship is moderated by the company's leverage.

H3: There is a negative relationship between direct carbon emissions and the company's Tobin's Q, and this relationship is moderated by the company's leverage.

H4: There is a negative relationship between indirect carbon emissions and a company's ROE, and this relationship is moderated by the company's leverage.

H5: There is a negative relationship between indirect carbon emissions and a company's ROA, and this relationship is moderated by the company's leverage.

H6: There is a negative relationship between indirect carbon emissions and the company's Tobin's Q, and this relationship is moderated by the company's leverage.

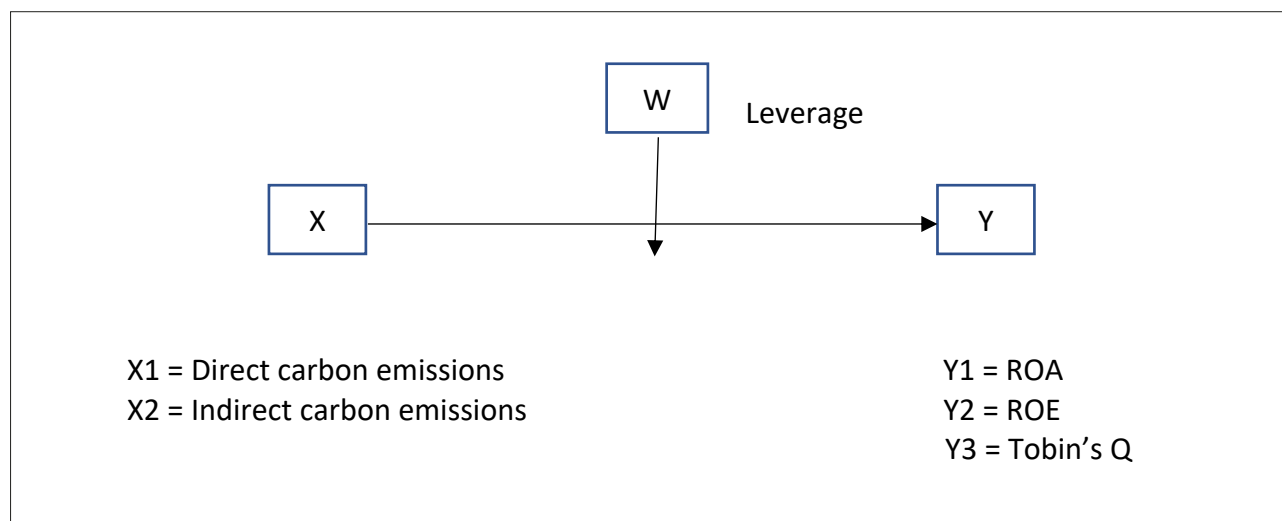


Figure 1. Theoretical framework model.

## DATA AND METHODOLOGY

### Data

The data employed in this study has been obtained from DataStream. The sample of the study consists of data from publicly listed New Zealand companies from Quarter 1, 2017, to Quarter 1, 2021. Our dataset is an unbalanced panel consisting of four years and 17 quarters. The total sample size consists of 49 companies from a variety of sectors that disclosed their carbon-emissions data. All continuous variables are winsorised at 5% to eliminate the effect of outliers.

## Methodology

The purpose of this paper is to examine the relationship between carbon emissions and corporate financial performance. In this paper, we will examine how carbon-emissions intensity (Scope 1 and 2) affects corporate financial performance and market value using indicators (ROE, ROA and Tobin's Q). Multiple regression techniques are used to assess the objectives and test the developed hypotheses. The paper uses heteroscedasticity-robust standard error estimates to verify the heteroscedasticity assumption of regressions.

The model is constructed as follows:

$$Y_{it} = \text{constant} + b_1CE1_{it} + b_2CE2_{it} + b_3S_{it} + e \quad (1)$$

where Y represents the dependent variables ROE, ROA and Tobin's Q; CE1 and CE2 represent Scope 1 and Scope 2 carbon emissions, and S is the firm's size. The Hausman test is used to judge whether to select a fixed-effect model or a random-effect model for panel data.

The next regressions were used to determine the change in the relationship between leverage and the firm's performance due to moderator leverage. The analysis is performed using the same equations with leverage as a moderating variable, an interaction term between moderating variable and carbon emissions 1 and 2.

## Direct and indirect carbon emissions – Independent variables

The excessive use of carbon emissions has been acknowledged as a major threat to sustainability (Bui & de Villiers, 2017). Businesses tend to use excessive carbon emissions, among others, through carburisation of energy structure; energy consumption inefficiency and irresponsibility; deforestation; the use of high-fossil carbon-based energy; urbanisation; and massive energy consumption (Bui & de Villiers, 2017; Huisingh et al., 2015; Lee & Cho, 2021). The carbon-emissions analysis for this paper comprises two variables: Scope 1 and Scope 2, which refer to carbon-emission levels gathered from New Zealand companies. According to Global Reporting, Scope 1 refers to emissions that are directly attributed to company practices or its controlled sources. Scope 2 refers to emissions indirectly produced from purchased energy. The paper analyses the intensity of carbon emissions from a company, and a log of carbon emissions has been used.

## Organisational leverage – Moderating variable

Leverage is the use of borrowed funds by an organisation. It is measured by the ratio of total debt to net worth. Firms with higher leverage may tend to disclose their carbon emissions, as the investors demand more transparent disclosures about socially responsible activities. Accordingly, it indicates the percentage of total assets of a company that were financed through liabilities, debt and/or creditors. In this vein, a high percentage of leverage indicates that the company has a high financial risk. As such, corporate shareholders deploy leverage to ascertain whether the firm has adequate funds to pay its current debts; it also evaluates whether the company can acquire viable financial benefits from its investments. Therefore, it is fair to argue that leverage could moderate the relationship between carbon emissions and organisational performance.

## ROE, ROA and Tobin's Q – Dependent variables

Three outcome variables determine the performance of the companies. In previous studies, ROA was chosen as a measure of profitability because it is one of the broadest measures of a firm's performance (Russo & Fouts, 1997). It is used to measure how effectively the business is using its assets to generate income. As a second variable, ROE is used, which is considered a suitable indicator of corporate shareholder returns (Artiach et al., 2010). The return on equity (ROE) is a measure of how efficiently companies manage their shareholders' capital. In general, the higher the ROE ratio, the higher the income growth. Tobin's Q is the third variable that is used to measure financial performance. It has been extensively used to measure the market valuation of organisations (Albertini, 2013; Garg,

2015; Yu & Zhao, 2015). Following Chung and Pruitt (1994), to obtain Tobin's Q value the book value of total assets is used as a proxy for the replacement cost of assets. Further, the market value is calculated as the *Market Value of Equity* plus the *Book Value of Debt* divided by *Total Assets*. Recent research has confirmed that Tobin's Q is a valid measurement for firm market valuation (El Ghouli & Karoui, 2017; Diab et al., 2019; Li et al., 2018, Puri, 2022). It reflects past performance and represents the firm's future development expectations (Li et al., 2018). Thus, this paper selects Tobin's Q to measure the firm's market value.

## Control variables

The study included firm size as a control variable. Previous studies show that large firms might turn out to be more efficient as they have better economies of scale, market experience, more skilled managers, better financial base, and established procedures that may lead to higher performance (Naik et al., 2014). Data for firm size is taken as an e-based logarithmic (ln) form of total assets.

Table 1. Summary of variable descriptions.

Variable	Measurement
ROA	The ratio of a firm's net profit to total assets
ROE	The ratio of net income to shareholders' equity
Tobin's Q	The market value of equity plus the book value of debt divided by total assets
Direct carbon emissions (Scope 1)	Log of emissions from sources that are owned or controlled by the reporting company
Indirect carbon emissions (Scope 2)	Log of emissions from the generation of imported (purchased) electricity, heat or steam consumed by the organisation
Size	The natural logarithm of the book value of a Firm's asset
Leverage	The ratio of a firm's total debt to the book value of its assets

## EMPIRICAL RESULTS

### Univariate analysis

Table 2. Summary statistics for all variables.

Variable	N	Mean	Std dev	Min	Max
ROA	993	4.342	8.099	-17.36	25.63
ROE	976	7.058	14.138	-30.03	42.03
Tobin's Q	988	1.601	2.319	0.227	10.525
Scope 1	351	9.519	3.142	4.5486	14.728
Scope 2	369	8.122	2.408	2.740	13.398
Total assets	988	13.898	1.272	11.598	15.940
Leverage	947	24.795	14.774	0.61	77.43

The summary statistics show all continuous variables of 49 New Zealand companies evaluated over four years. For the sample companies, the average ROE was 7.05, which indicates the mean return on investment from equity for a particular company. The average (median) ROA was 4.3, which indicates the average amount of return on firm

investment from assets. The mean value for the market value of companies is represented by Tobin's Q 1.6. Based on the mean values in the sample, it can be concluded that the companies in the sample are profitable. The average of Scope 1 emissions (CE1 intensity) is 9.5%. This suggests that an ordinary company selected from the sample could produce a typical value of 9.5% Scope 1 emissions. The mean of Scope 2 emissions (CE2 intensity) is 8.12%. Furthermore, the average firm size and leverage are 13.8 and 24.7, respectively. On average, the selected firms for this study were highly leveraged.

Table 3. Correlation matrix for all variables.

	ROA	ROE	Tobin's Q	Scope 1	Scope 2
ROA	1				
ROE	0.913	1			
Tobin's Q	0.270	0.196	1		
Direct carbon	-0.345	-0.3348	-0.184	1	
Indirect carbon	-0.117	-0.0917	0.057	0.482	1
Company size	-0.101	-0.1148	-0.266	0.302	0.200
Leverage	-0.305	-0.207	-0.050	0.120	0.117

Table 3 shows Pearson's correlation matrix result for all variables. Both direct carbon emissions and indirect emissions are negatively correlated with ROA and ROE. Tobin's Q has a negative association with Scope 1 emissions but is positively associated with Scope 2 emissions. Among independent variables, there is no significant correlation. As a result, the results are not biased by the multi-collinearity problem.

## Multivariate analysis

Table 4. Panel data regression.

VARIABLES	ROE	ROA	Tobin's Q
Scope 1	-0.475*	-1.142*	-0.041
	(0.080)	(0.065)	(0.485)
Scope 2	-0.042	-0.179	0.0494
	(0.844)	(0.717)	(0.295)
Total assets	0.640	3.461	-1.599***
	(0.914)	(0.102)	0.000
Constant	1.470	-28.58	24.51***
	(0.904)	(0.312)	(0.000)
Observations	347	332	347
R-squared	0.10	0.15	0.21

Finally, we ran a fixed effect multi-regression to test the posited hypotheses. Table 4 presents the results of the panel regressions for three different outcome variables: ROE, ROA and Tobin's Q. The regression in the specification controls for firm fixed effects. It shows the estimation outcomes for Scope 1 and Scope 2 emissions on financial performance. All variables (except for the dummy variable) are winsorised at 5%. The symbols \*, \*\*, and \*\*\* denote significance at the 10%, 5%, and 1% levels, respectively. P-values are reported in parentheses. The results of the

Hausman test indicate that the p-value is insignificant at a 5% level in all three regressions. Hence, we used the random effects model.

Table 5. Panel data regression with leverage as a moderating variable.

VARIABLES	ROE	ROA	Tobin's Q
Scope 1 with leverage as a moderating variable	-0.039***	-0.219***	-0.013***
	(0.001)	(0.000)	(0.000)
Scope 2 with leverage as a moderating variable	0.0661**	0.254***	-0.00951*
	(0.029)	(0.000)	(0.092)
Total assets	2.020	9.022***	-1.867***
	(0.190)	(0.004)	(0.000)
Constant	-8.289	-104.8**	21.37***
	(0.739)	(0.041)	(0.000)
Observations	328	324	328
R -squared	0.203	0.357	0.503

Table 5 presents the results of the panel regressions for three different outcome variables: ROE, ROA and Tobin's Q. The regression in the specification controls for firm fixed effects. All variables (except for the dummy variable) are winsorised at 5%. The symbols \*, \*\*, and \*\*\* denote significance at the 10%, 5%, and 1% levels, respectively. P-values are reported in parentheses.

## DISCUSSION, LIMITATIONS AND FUTURE STUDIES

### Theoretical implications

The results of this study offer several theoretical implications. The results show there is an inverse relationship between direct carbon emissions and organisational performance. The impact of Scope 1 emissions on ROA and ROE is significantly negative. This shows that an increase in Scope 1 emissions decreases corporate ROA and ROE. This is a straightforward implication that carbon emissions represent an additional cost, resulting in the reduced organisational performance. It supports the win-win approach that by reducing carbon emissions firms can improve their competitiveness. It highlights the potential for businesses to improve their financial performance while simultaneously sustaining the environment. Furthermore, a win-win approach aligns with the values of environmentally conscious stakeholders, including investors, consumers, employees and communities. The empirical findings do not support the win-lose theory, which posits that companies face a trade-off between environmental responsibility and profitability. When companies increase their carbon emissions proactively, there is significant negative impact on their profitability.

Surprisingly, the study found the relationship between Scope 2 carbon emissions and ROE, ROA and Tobin's Q is insignificant. This could be because companies have no control over indirect emissions; hence they have no significant effect on financial performance. It can further indicate that investor groups do not view indirect emissions (particularly in the short term) as damaging to corporate reputation. Often, indirect emissions are caused by suppliers' activities and transportation. Environmentally unfriendly suppliers can increase the firm's costs if their emissions are too high. The reduction of indirect emissions can contribute to a positive impact on supply-chain relationships, profits and cost control.

The findings indicate that carbon-emission increases have a negative impact on the financial performance of firms and do not increase the value of the firm. There is a growing awareness among both buyers and investors about the impact a firm may have on the environment. Increased emissions are likely to reduce corporate investment capacity. Furthermore, ROE considers equity capital rather than debt, indicating stakeholders are concerned about the issues of carbon emissions in the short term.

The study also posits the effect of leverage as a moderating variable. When leverage is added as a moderating variable to the equation, financial performance and market value decrease, which is represented by ROE, ROA and Tobin's Q. The coefficient for ROE, ROA and Tobin's Q is negative and significant. This suggests that leverage has a significant effect on the performance of companies and illustrates that increases in emissions will decrease the firm's value and performance. The negative associations might be explained by how buyers and investors perceive companies' attempts to reduce carbon emissions, as well as their negative sentiments towards environmentally destructive firms. The significant positive relationship between Scope 2 emissions and ROE and ROA suggests that stakeholders, including investors, may not pay much attention to indirect emissions generated by the firm, as those emissions are not under the company's control or accountability. In such cases, investor groups do not view indirect emissions as detrimental to corporate reputations.

## Managerial implications

The results of this study are humbling. The study has observed the way in which carbon-emission cost reduces organisational financial performance. More specifically, the study findings show that carbon emissions reduce firms' financial performance and market value. By using both direct and indirect carbon emissions as dependent variables, the current study provides a more accurate view, since firms may focus on cutting direct emissions but ignore indirect emissions. The results of the study have significant managerial and social implications for managers, policymakers and consumers.

First, based on Social Identity Theory, the findings support that shared identity within the business community and society at large influences a company's decision to practice sustainability. A firm may adopt sustainable practices to conform to the expectations of a group if sustainability becomes a norm within that industry, motivated by the desire to gain social recognition and approval. Consequently, the shared identity of companies can encourage them to explore environmentally responsible ways of doing business.

Second, by providing insight into the impact of direct and indirect carbon emissions on financial and market performance, the study offers evidence that organisations should act in a more eco-friendly way if they want to gain economic benefit. The goal is to raise awareness of the negative effects of carbon emissions, irrespective of the extent of emissions and the type of firms involved. So what can the organisations do to influence carbon-emission reduction? Business organisations could act responsibly by attempting to reduce fossil carbon-emissions by consuming efficient energy (Robaina-Alves et al., 2015). Carbon emissions are generated in almost all activities of industrial sectors, including extraction of materials from the earth's crust, production, procurement, inventory management, order processing, transportation, usage, and end-of-life management of used products (Huisinigh et al., 2015). One of the strategies that businesses could adopt to reduce carbon emissions is technological investment (Robaina-Alves et al., 2015; Slovak & Taticchi, 2015). Studies have shown that some new carbon-reduction technologies, if effectively applied across various sectors, would help to alleviate the growing climate-change crises (Slovak & Taticchi, 2015). Businesses must radically transform their operations towards low- or no-fossil-carbon economies if they want to improve their organisational financial performance.

Third, this study's results provide a rationale for policymakers to enact regulations to mitigate firm-level carbon emissions and contribute to a greener environment. To reduce carbon emissions, policymakers must augment existing programmes, and enforce tough and robust technical benchmarks and rules to directly and indirectly reduce carbon emissions in corporate operations. The government should also create long-term incentives that will encourage companies to adopt efficient green technologies and acquire environmentally compatible processes and systems that will mitigate the impacts of global warming. The study findings provide support for



the argument that the world needs to encourage low-carbon environments through an international collective of initiatives, supported by consensus and co-ordinated action. Additionally, the continuous implementation of societal views on climate change is necessary to increase stakeholder understanding of climate change, leading to policy adjustments. Furthermore, the findings offer insight to academics and policymakers, who are increasingly interested in how carbon emissions affect firm performance, partly because of increased shareholder activism but primarily due to unprecedented increases in atmospheric carbon.

Finally, companies operate in a profit-driven framework, where financial objectives are the most important. Nonetheless, businesses are increasingly aware of the importance of integrating sustainability considerations into their strategic plans, as concerns about the environment and regulatory pressure regarding carbon emissions increase. There is a new paradigm emerging in which companies strive to balance profitability with sustainability.

## **LIMITATIONS AND FUTURE STUDIES**

This study has several limitations that may provide opportunities for future studies. Firstly, data were collected from only 49 publicly listed companies in New Zealand, a mature market in a developed country that has emphasised the reduction of carbon emissions. It is conceivable that the environment, government policies and the business culture contribute to the study results. However, the subset of firms that voluntarily report carbon emissions might not be representative of all businesses. It might be a representation of early adopters who are more inclined to showcase their commitment to sustainability. Alternatively, firms that do not voluntarily disclose their emissions might still be striving to improve their practices.

Additionally, there is a risk of bias occurring in firms with higher levels of leverage. The firms report carbon emissions activity because of lenders' insistence and the reported data may not be representative of the genuine efforts of the borrowers, but rather an attempt to respond to external pressure. Thus, these companies may feel compelled to disclose their carbon-emissions data more prominently or improve their environmental performance to comply with lender requirements.

Lastly, the study is based on four-year dataset of firms that disclosed carbon emissions. It would be interesting to conduct future studies in different environments and cultures to gain a deeper understanding of the effect of carbon emissions.

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# Estimation of Aotearoa New Zealand's Food and Fibre Sector's Export Specialisation with Key Trading Partners

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## Brief Research Report



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## ABSTRACT

The food and fibre industry plays a vital role in Aotearoa New Zealand's economy, accounting for more than 80% of merchandise exports. Major items of the sector include dairy, meat, forestry and horticulture. Key Asian export markets include Singapore, China, Malaysia, Hong Kong, China, Korea and Thailand, with which New Zealand has negotiated Free Trade Agreements (FTAs). FTAs are aimed at enhancing trade flows among the member countries, enabling each member country to specialise in the export of those goods in which they have a comparative advantage, which in turn depends on their resource endowment. The twin objectives of this paper are to examine the changes in New Zealand's overall exports, and the export specialisation of the food and fibre sector to the selected trading partners, in the pre- and post-FTA years. This is achieved by estimating the Trade Intensity Indices for total exports, followed by an estimation of Export Specialisation Indices for the products within the food and fibre sector. A t-test was applied to assess the significant changes in these indices between the pre- and post-FTA years. The results present a mixed picture for both indices, indicating that New Zealand has yet to realise the full benefits of Free Trade Agreements with some countries.

## KEYWORDS

Food and fibre industry, Free Trade Agreement, comparative advantage, Trade Intensity Indices, Export Specialisation Indices

## INTRODUCTION

International trade plays a significant role in Aotearoa New Zealand's economy, accounting for 49% of GDP. A prominent feature of New Zealand's exports is that primary exports account for about 75% of total merchandise exports as New Zealand is endowed with natural resources. Given the small market size and low capital base with limited access to economies of scale, New Zealand depends on international trade for economic prosperity. As trade is the lifeline of the economy, in order to ensure a smooth flow of goods and services into and out of the country, New Zealand has, *inter alia*, negotiated bilateral free trade agreements (FTAs) with countries in the Asia-Pacific region. Notable among them are the Closer Economic Partnership (CEP) with Singapore (2001), the New Zealand-Thailand CEP (2005), the New Zealand-China Free Trade Agreement (2008), the New Zealand-Malaysia Free Trade Agreement (2009), the New Zealand-Hong Kong, China Closer Economic Partnership (2010), and the Korea-New Zealand Free Trade Agreement (2015). It may be noted that the number of bilateral FTAs signed from the year 2000 has been much higher compared to the period between 1983 and 1999. Also, most of the FTAs signed during this period are with countries from the Asian continent. There are a number of reasons for this trend of trying to penetrate Asian markets, such as the large market size, growing income levels, and ease of trading due to liberal trade policies. Susanto and Admi (2021) analysed the demand determinants of Indonesia's coal exports to six Asian economies and found that market size had a significant positive effect on coal exports. As can be expected, trade agreements with large economies facilitate free trade, resulting in higher trade values. The share of trade as a percentage of New Zealand's GDP remained steady at about 50% from 1971 to 2020, which can be attributed to gaining access to large markets as a result of FTAs. Domestic consumers also benefit from free-trade policies in that they have access to cheaper and a greater variety of imported goods, resulting in increased consumer welfare. The New Zealand Institute of Economic Research (2017) estimated that the gains to New Zealand households from

improved product choices resulting from international trade would be in the region of \$3.9 billion per year. In addition, the purchasing power of New Zealand households increased by more than 30%.

The aim of this paper is to analyse the impact of FTAs on New Zealand’s merchandise exports to selected Asian markets, with a particular focus on the food and fibre sector. The rest of the paper presents an overview of the FTAs and New Zealand’s exports, a literature review, and the methodology of the study, followed by results and conclusion.

## AN OVERVIEW OF AOTEAROA NEW ZEALAND’S EXPORTS TO KEY ASIAN MARKETS

A snapshot of the increase in New Zealand’s exports to key Asian markets is presented in Table 1. New Zealand has negotiated bilateral FTAs with six Asian countries between the years 2001 and 2015, which are currently in force. These bilateral FTAs are in addition to regional FTAs such as the ASEAN–Australia–New Zealand Free Trade Agreement (AANZFTA) negotiated in 2012, and the Comprehensive and Progressive Agreement for Trans-Pacific Partnership (CPTPP) signed in 2018, which includes both Asian and non-Asian countries such as Mexico, with large domestic markets. In the year 2021, exports to China, currently New Zealand’s largest export market, amounted to 671% of exports to that country in 2008, i.e., the year when the FTA came into force. Exports to Singapore and Thailand in 2021 also recorded impressive growth compared with their respective FTA years. Although exports to Malaysia, Hong Kong, China, and Korea increased in 2021, the increase was relatively less than for the other countries. Thus, there is evidence of the overall positive impact of bilateral FTAs on New Zealand’s exports to partner economies.

Table 1. An overview of FTAs and Aotearoa New Zealand’s exports.

Country	FTA year	Exports (US\$M)	Exports (2021) (US\$M)	% Increase
Singapore	2001	168	804	379%
Thailand	2005	238	768	223%
China	2008	1,806	13,932	671%
Malaysia	2009	443	725	64%
Hong Kong, China	2010	624	771	24%
Korea	2015	1,098	1,394	27%

Source: UN Comtrade.

## LITERATURE REVIEW

Free trade benefits the member countries in several different ways, e.g., efficient utilisation of resources and accelerated economic growth, ultimately enhancing consumer welfare. A global organisation, the World Trade Organization (WTO) came into existence in 1995, superseding the General Agreement on Tariffs and Trade (GATT) to ensure smooth trade flows among the member countries. The WTO is a platform for countries to negotiate free trade agreements, and provides the necessary support mechanism to monitor such agreements and settle any disputes among the member countries. However, a multilateral free trade agreement covering all 164 countries around the world has not materialised, due to a lack of consensus among the members. The complexities associated with multilateral agreements resulted in the collapse of WTO negotiations and the failure of the member countries to reach an agreement at Doha in 2001 and in subsequent rounds, i.e., in Cancun, 2003, and in Geneva, 2008 (Ahnlid, 2012; Baldwin, 2016). The failure of multilateral negotiations resulted in an increase in FTAs, which have become an important vehicle to integrate with the global economy through trade liberalisation and domestic reforms, and boost economic relations with partner countries (Dong et al., 2016). As a consequence, there has



been a proliferation of regional trade agreements (RTAs), consisting of two or more participating countries, which aim to reduce trade barriers in order to increase trade, and facilitate the movement of capital and labour among the member countries. The number of RTAs in force across the world has risen from 81 in the year 2000 to 355 by 2022, reflecting the significance of trade agreements in eliminating the hurdles to free trade. The gains of FTAs include diversification of markets and diversification of commodities exported, resulting in increased exports for the participating member countries (Cubillos et al., 2021). Several countries, with the aim of achieving higher economic growth and enhancing the production of consumer goods and services in a cost-effective manner, negotiate bilateral free trade agreements that ultimately promote multilateral trade (Trakman, 2008). Minh et al. (2018) differentiate between traditional FTAs and New Generation FTAs. The former focus mainly on liberalising trade in goods, while the latter tend to be more comprehensive, covering trade in services, investment, e-commerce, competition policy and more. The authors found that the new-generation FTAs had a positive impact on Vietnam's economic development, increased access to markets, increased exports and increased FDI inflows due to an improved business environment. FTAs also result in trade facilitation, thus reducing the costs of trade and adding to economic growth. Sohn and Lee (2010) found a positive effect of FTAs on economic growth by eliminating both tariff and non-tariff barriers, and liberalising investment flows.

Even though studies suggest that FTAs result in enhanced trade flows at the aggregate level, the benefits arising from increased trade flows may not be evenly distributed at the firm level. Large firms might gain from such FTAs while small firms might not (Baccini, 2019). It is also possible that if a country negotiates FTAs with several countries, contradictory results are possible in terms of their effect on the country's exports. Nicaragua signed FTAs with Guatemala, Honduras, El Salvador, the United States, Costa Rica and Panama. González et al. (2018) applied the gravity model to analyse the effects of FTAs on Nicaraguan agricultural exports and found that an FTA with Panama had a negative impact while FTAs with the remaining countries had a positive impact, implying that the benefits of FTAs may not be uniform at macro and micro levels. It is possible that different countries experience different effects of FTAs on the exports of similar goods. Palm oil exports by Indonesia increased by an average of about 65% in the post-FTA years between 2001 and 2011. Whereas in the case of Malaysia during the same period, palm oil exports declined by an average of 21% in the post-FTA years (Pujiati, 2014). Francis and Kallummal (2020) argue that India's preferential trade agreements with the ASEAN countries, and South Korea and Japan had an adverse effect on the domestic manufacturing and innovation ecosystem, particularly within the electronics manufacturing sector; i.e., imports of electronics increased by 100% between 2009 and 2019, while exports only increased by 50%. The trade effects of RTAs on the member economies tend to be mixed as well. In a study on the effects of the ASEAN+6 (China, India, Japan, South Korea, Australia, New Zealand) FTA on trade creation and trade diversion using the gravity model, it was found that the FTA resulted in trade creation for primary as well as manufactured goods among the member countries and increased exports to extra-FTA countries (Handoyo et al., 2021). A comparative study of the Latin American and Asian experience found that MERCOSUR (the Southern Common Market) created more trade among the member countries, whereas, in the case of ASEAN, trade diversion was more significant than trade creation (Aditya & Acharyya, 2012). Given the mixed effects of FTAs on the member countries, this paper examines the impact on New Zealand's overall exports to key export markets, and the degree of export specialisation in regard to the food and fibre sector during the pre- and post-FTA years.

## METHODOLOGY

Six Asian countries (Singapore, Thailand, China, Malaysia, Hong Kong, China, and Korea) with which New Zealand has negotiated FTAs have been selected for this study. These countries are New Zealand's major export destinations in Asia as they take more than 40% of this country's merchandise exports. At the sectoral level, the food and fibre sector was chosen for the study as it accounts for more than 50% of New Zealand's merchandise exports. The sector consists of primary product groups such as dairy, meat, wood, horticulture and wool. The overall influence of FTAs is measured by computing the trade intensity indices ( $T_{ij}$ ) to assess whether New Zealand has been exporting more to the selected markets than to the rest of the world in the post-FTA years compared to the pre-FTA years. This is followed by the calculation of export specialisation indices (ES) to examine the changes in New Zealand's export

specialisation of products within the food and fibre sector in these markets. A t-test was used to test the hypothesis that the mean values of both these indices are significantly different in the post-FTA years compared to the pre-FTA years. A two-tailed t-test assuming unequal variances was applied, as New Zealand signed the FTAs with different countries in different years (Table 1), resulting in different sample sizes. The two-directional hypothesis is tested, for it is quite likely that the mean values of some indices may have declined in some markets in the post-FTA years. It may also be noted that these indices are a better representation of overall trade and export specialisation compared to the absolute export values. The calculations are based on secondary data extracted from UN Comtrade and WTO databases from 1995 to 2021.\*

The trade intensity index indicates whether the value of trade between two countries is greater or smaller than would be expected on the basis of their importance in world trade. It is measured as the share of one country's exports going to a partner divided by the share of world exports going to the partner country.

$$T_{ij} = (X_{ij}/X_{it})/(X_{wj}/X_{wt})$$

Where  $X_{ij}$  and  $X_{wj}$  are the values of country  $i$ 's exports and of world exports to country  $j$  and where  $X_{it}$  and  $X_{wt}$  are country  $i$ 's total exports and total world exports respectively. An index of more than unity indicates whether a country exports more, as a percentage, to a partner than the world does on average, and an index of less than unity indicates a country exports less, as a percentage, to a partner than the world does on average (Malik & Rather, 2018; WITS).

The export specialisation index (ES) provides product information on revealed specialisation in the export sector of a country vis-à-vis specific markets or partners. A value of  $>1$  represents specialisation in a particular market for a particular product, whereas a value of  $<1$  represents comparative disadvantage in that market.

$$ES = (X_{ij}/X_{it})/(M_{kj}/M_{kt})$$

Where  $X_{ij}$  is the value of country  $i$ 's export of product  $j$ ;  $X_{it}$  represents the total export of country  $i$ ;  $M_{kj}$  is the value of import of product  $j$  in market  $k$ ;  $M_{kt}$  is the total import in market  $k$  (Bernatonyte, 2015; Anukoonwattaka, 2017).

The following hypotheses are tested to assess whether there has been a significant increase/decrease in the trade intensity indices and export specialisation indices during the post-FTA years compared with pre-FTA years:

H0: There is no significant difference in mean values of the indices between the pre- and post-FTA years.

H1: There is a significant difference in mean values of the indices between the pre- and post-FTA years.

## RESULTS AND DISCUSSION

The trends in trade intensity indices for each of the partner countries are presented in Table 2 in five-year intervals. New Zealand's trade intensity indices with Singapore, Thailand, China, Malaysia and Korea have increased in the respective post-FTA years. The value of indices exceeded unity, indicating that, on average, New Zealand exports more to these countries in relative terms than the rest of the world does. Particularly in the case of China, New Zealand's largest trading partner, the index of 2.83 in 2021 represents a substantial improvement in the post-FTA period compared with  $<1$  (0.99) in 1995. A marginal decline is noted in the case of Hong Kong, China from 0.69 in 2010 to 0.59 in 2021, with the value staying below unity even in the post-FTA years. Given the mixed trade intensity values in the post-FTA years, it is relevant to analyse the changes in the food and fibre sector's export performance in these markets. The export specialisation indices (ES) for each of the products within the food and fibre sector for each of the markets during the pre- and post-FTA years are presented in Table 3. Dairy products, being the major component of the food and fibre sector, accounting for 42% of exports, recorded an increase in Singapore, Thailand, Malaysia and Hong Kong. There has been a substantial decline in New Zealand's largest export market, China, followed by Korea. The reason for the decline in the ES value for China is that Chinese imports of dairy products as a ratio to total imports increased by 3.7 times while New Zealand's dairy exports as a ratio to total merchandise

exports increased by 1.7 times between 2008 and 2021. The ES value of meat, the second major item of export, i.e., 21% of total exports, declined in all the markets during the study period. The indices declined as much as 80–90% in Thailand and China. Thailand's ratio of meat imports to total imports increased by 11 times and China's by 7.5 times, while New Zealand's ratio of meat exports to total exports remained the same. There has been an increase in the ES values of wood in all markets except Malaysia, where a marginal decrease has been noted. The value remained the same for China, the largest export destination for New Zealand's forestry exports. Horticulture, consisting of fruit and vegetables, recorded a decline in ES values in all the markets except in Singapore. New Zealand's horticulture exports as a ratio of total exports increased by 1.4 times compared to a ten-fold increase in imports in the case of Thailand and four-fold increase in China.

The t-test results for trade intensities present a mixed picture (Table 4). Although the hypothesis is accepted for four of the six countries, a significant increase in mean trade intensities is observed in the cases of Singapore and China, while a decrease is noted for Hong Kong, China and Korea. The null hypothesis is accepted in the case of Thailand and Malaysia. Thus, the effects of FTAs on overall exports are not uniform across all the trading partners.

With regard to the export specialisation of specific product groups within the food and fibre sector, the results are varied (Table 5). The hypothesis is accepted for dairy products in some markets, i.e., Singapore, Thailand and Malaysia, which recorded a significant increase in the mean ES values, while a decline is observed in China and Korea. The implication is that New Zealand's comparative advantage in dairy products is not uniform in all the markets.

It can be seen from Table 5 that New Zealand's specialisation in wood exports has enhanced in all the markets during the post-FTA years, except in the case of Malaysia, where the hypothesis is rejected i.e., no significant difference between the pre- and post-FTA years.

Meat stands out, as the hypothesis is accepted for all the markets, i.e., a significant decrease in the mean ES values during the post-FTA years, implying a decrease in New Zealand's comparative advantage in this group. A similar conclusion can be drawn for horticulture, except for Singapore.

The null hypothesis is accepted for wool in four of the six markets, while a significant increase in the mean ES values is noted in China, and Hong Kong, China.

Table 2. Trade intensity indices.

Country	1995	2000	2005	2010	2015	2021
Singapore	0.58*	0.80*	0.73**	0.93**	1.23**	1.08**
Thailand	0.98*	1.20*	0.98*	1.30**	1.30**	1.11**
China	0.99*	0.91*	0.81*	1.22**	1.73**	2.83**
Malaysia	1.40*	1.61*	1.40*	1.66**	1.81**	1.66**
Hong Kong, China	0.80*	0.82*	0.59*	0.69*	0.46**	0.59**
Korea	1.97*	1.81*	1.41*	1.17*	1.21*	1.24**

\* Pre-FTA years

\*\* Post-FTA years

Source: Calculations based on UN Comtrade and WTO databases.

Table 3. Export specialisation indices.

Country/ Year	Dairy HS-04						Meat HS-02						Wood HS-44						Horticulture HS (07+08)						Wool									
	19 95	20 00	20 05	20 10	20 15	20 21	19 95	20 00	20 05	20 10	20 15	20 21	19 95	20 00	20 05	20 10	20 15	20 21	19 95	20 00	20 05	20 10	20 15	20 21	19 95	20 00	20 05	20 10	20 15	20 21				
Singapore	*	*	**	**	**	**	*	*	**	**	**	*	*	*	**	**	**	*	*	*	**	**	**	*	*	*	**	**	**	*	*	**	**	**
Thailand	*	*	*	**	**	**	*	*	*	**	**	*	*	*	*	**	**	*	*	*	*	**	**	*	*	*	*	**	**	*	*	**	**	
China	*	*	*	**	**	**	*	*	*	**	**	*	*	*	*	**	**	*	*	*	*	**	**	*	*	*	*	**	**	**	**	**		
Malaysia	*	*	*	**	**	**	*	*	*	**	**	*	*	*	*	**	**	*	*	*	*	**	**	*	*	*	*	**	**	*	*	**	**	
Hong Kong, China	*	*	*	*	**	**	*	*	*	*	**	*	*	*	*	*	**	*	*	*	*	*	**	*	*	*	*	*	**	*	*	**	**	
Korea	*	*	*	*	*	**	*	*	*	*	**	*	*	*	*	*	*	**	*	*	*	*	*	*	**	*	*	*	*	*	*	**	**	

\* Pre-FTA years

\*\* Post-FTA years

Source: Calculations based on UN Comtrade and WTO databases.

Table 4. Trade intensity indices – analytical results.

Country/Year	Observations (Pre-FTA)	Observations (Post-FTA)	Mean (Pre-FTA)	Mean (Post-FTA)	p-two-tailed*
Singapore	6	21	0.73	0.96	0.000
Thailand	10	17	1.13	1.27	0.180
China	13	14	0.94	1.84	0.000
Malaysia	14	13	1.74	1.71	0.760
Hong Kong, China	12	12	0.70	0.59	0.003
Korea	20	7	1.64	1.14	0.000

\*Significant at  $\alpha = 0.05$

Table 5. Food and fibre sector – ES analytical results.

Product			Dairy			Meat			Wood			Wool			Horticulture		
Country	Pre-FTA n	Post-FTA n	Pre-FTA Mean	Post-FTA Mean	P*	Pre-FTA Mean	Post-FTA Mean	P*	Pre-FTA Mean	Post-FTA Mean	P*	Pre-FTA Mean	Post-FTA Mean	P*	Pre-FTA Mean	Post-FTA Mean	P*
Singapore	6	21	54.06	73.34	0.000	69.90	57.38	0.000	18.04	50.00	0.000	332.28	471.04	0.080	10.20	16.19	0.000
Thailand	10	17	32.44	78.28	0.000	1494.15	481.73	0.000	7.40	25.04	0.000	28.47	34.62	0.170	35.11	12.56	0.000
China	13	14	222.71	129.31	0.000	131.60	38.17	0.000	5.35	7.54	0.000	5.38	7.28	0.002	37.61	13.86	0.000
Malaysia	14	13	35.85	56.65	0.000	58.91	30.15	0.000	25.78	22.84	0.158	64.19	73.17	0.332	10.11	7.30	0.000
Hong Kong, China	12	12	67.99	77.17	0.105	23.48	12.98	0.000	18.63	96.99	0.000	9.34	13.28	0.000	9.21	7.06	0.000
Korea	20	7	200.18	134.41	0.000	23.70	13.48	0.000	7.34	11.86	0.000	16.23	14.27	0.221	18.40	12.46	0.000

\* Significant at 0.05

## CONCLUSION

An examination of the absolute values of trade intensity indices with key Asian trading partners prior to and after negotiating the bilateral FTAs indicates that there has been a definite increase in the index values in the post-FTA years, in all the markets except Hong Kong, China. This implies that, overall, New Zealand exports more to these countries as a percentage than rest of the world does on average. However, the t-test results present a more mixed picture, as shown in Table 5.

An analysis of the performance of specific products in terms of export specialisation within the food and fibre sector shows that the ES values exceeded unity for all the food and fibre products in all six markets during the study period, implying New Zealand's export specialisation in this sector. However, the ES values of dairy, meat and horticulture have declined during the study period, as imports of these products by countries such as China as a percentage of total imports increased at a higher rate than the percentage increase in New Zealand's exports. Wood, a major component of the food and fibre sector, has shown an increase in all markets except in Malaysia. The t-test results for the differences in the mean ES values between the pre- and post-FTA years more or less confirm these conclusions. The overall conclusion is that the bilateral FTAs with the large Asian countries have had a positive impact on New Zealand's overall exports. In the food and fibre sector, dairy and wood have recorded gains, while meat and horticulture have recorded a significant decline during the post-FTA years. Further research may be aimed at finding ways to increase New Zealand's comparative advantage in specific products in specific markets, e.g., meat, which will enable New Zealand exporters to enjoy the benefits of free trade agreements.

## LIMITATIONS

The study considered only quantitative data relating to New Zealand's merchandise exports, and imports by specific countries during the pre- and post-FTA years. The changes in global economic conditions, transitional effects, etc., that may have had an effect on bilateral trade have not been taken into account. To ensure uniformity, data from 1995 has been analysed due to the paucity of data for the prior years in the case of some countries.



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# The Nexus Between ESG Disclosures, Firm Performance and Covid-19: An Aotearoa New Zealand Perspective

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## Research Report



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## ABSTRACT

This paper investigates the impact of environmental, social and governance disclosures (ESGD) on the corporate performance of Aotearoa New Zealand companies during the Covid-19 pandemic. The study sample consists of quarterly data for publicly listed New Zealand companies from 2017 to 2021, with 2017–2019 as the pre-Covid-19 period and 2020–2021 as the Covid-19 period. Correlation analysis and panel regression models are used to test hypotheses and assess objectives. The findings show that during Covid-19, there was no significant relationship between ESG scores (ESGS) and financial performance. However, after adding financial slack as a moderating variable, the relationship between ESGS and financial performance became significant, which suggests that when companies have surplus funds, they invest in ESG-related activities, which enhances both their performance and reputation. This study is helpful to academics, firms and policymakers interested in understanding the impact of sustainable practices on businesses. Furthermore, the findings provide insight into initiatives that regulatory authorities might take to improve ESGD and reporting among New Zealand companies for long-term value creation.

## KEYWORDS

ESG disclosures, Covid-19, business performance, market value, sustainability

## INTRODUCTION

A recent outbreak of coronavirus (Covid-19) caused major imbalances in many countries' economic governance, supply chains and political systems. The World Health Organization declared Covid-19 as a global health emergency on 30 January 2020, with governments taking strict measures to limit its spread, including closures and social distancing (United Nations, 2020)

The effects of Covid-19 on the economy and capital markets around the globe have been examined in a few recent academic studies. Studies conducted by Gormsen & Koijen (2020) and Pagano et al. (2020) conclude that the risk level of all countries increased when Covid-19 spread to more than 200 locations. The global economy and financial markets were deeply affected by the pandemic's rapid spread (Chen & Chia-Wei, 2021). McKibbin and Fernando (2020) report that the Covid-19 outbreak had an immediate negative effect on the global economy. Zou et al. (2020) document that the Covid-19 pandemic affected every aspect of the global economy and society.

Additionally, the Covid-19 pandemic had a significant impact on the economy of New Zealand. The country's GDP declined by around 4% in 2020 due to the economic effects of the pandemic, according to the Reserve Bank of New Zealand (2020). The unemployment rate rose to 5.3% in the June 2020 quarter, compared to 4.0% in March 2020 and the pandemic adversely affected capital market volatility in the first quarter of 2020, resulting in significant financial losses for most New Zealand firms (Reserve Bank of New Zealand, 2020).

During crises such as Covid-19, society scrutinises financial performance more closely, making it imperative for firms to act responsibly (Miller et al., 2022). This may be a result of businesses trying to enhance their reputations over time by demonstrating compliance with their ethical obligations and strengthening their relationships with their stakeholders. Alewine and Stone (2013) argue that sustainable development encompasses more than just corporate social responsibility (CSR) and that non-financial information is vital for managers to be successful in achieving their

environmental goals. Consequently, investors, governments, regulators, firms and non-governmental organisations are increasingly concerned about ESG issues (Lee et al., 2016).

With such growing interest, there have been numerous studies that have examined the ESG score (ESGS) impact on financial performance (Friede et al., 2015; Lo & Sheu, 2007; McWilliams & Siegel, 2000; Ortas et al., 2015; Waddock & Graves, 1997). However, previous studies have produced differing viewpoints on the relationship between environmental, social and governance activities, and financial performance. A positive ESG perspective argues that socially and environmentally responsible business practices can build long-lasting relationships with stakeholders as well as increase trust in a company that demonstrates operating efficiency (Brammer & Millington, 2008), employee productivity (Valentine & Fleischman, 2008) and capital market benefits (Dhaliwal et al., 2011; Godfrey, 2005).

In contrast, other researchers suggest a negative relationship between environmental, social and governance activities, and financial performance. They argue that ESG increases costs, making it economically disadvantageous (Aupperle et al., 1985). As a result of ESG activities, fewer resources are available, making it harder for firms to respond to unexpected business crises. If ESG activities are driven by opportunism (e.g., to improve managers' reputations), ESG expenditures will become costs rather than investments, undermining the firm's value. Some studies argue that ESG activities negatively affect financial performance (Barnea & Rubin, 2010; Griffin & Mahon, 1997). Additionally, some researchers have found no evidence of a relation between ESGs and firm performance.

During Covid-19, companies needed to allocate resources optimally during national lockdowns, hence it would be interesting to investigate the performance and value of the companies implementing sustainable practices during the pandemic.

Despite New Zealand's high concern for company governance, social equality and the environment, there is little academic evidence on ESGs and financial performance for New Zealand firms during Covid-19. Additionally, there have been differing views on the relationship between ESGs and financial performance. Based on these gaps, the study examines the effect of ESG activities on the financial performance and market value of companies during Covid-19. More specifically, it addresses the following research questions:

1. What is the impact of the ESGs on the financial performance of New Zealand companies during Covid-19?
2. What is the impact of the ESGs on the market value of New Zealand companies during Covid-19?
3. Does financial slack (FS) moderate the relationship between ESGs and return on equity (ROE), return on assets (ROA) and Tobin's Q during Covid-19?

The research contributes to the literature in three significant ways:

1. It adds to the theoretical literature by examining resource-based views, stakeholders' theories and legitimacy theory to understand how ESGs influence company financial performance and market valuation in critical times such as the Covid-19 pandemic.
2. The findings of the research have practical implications for managers of companies, to enable them to understand the significance of incorporating ESGs into financial performance reporting. By investing surplus cash in ESG activities, firms are able to strengthen relationships with employees, customers, communities and investors.
3. It also reflects upon the need to have a proper framework of ESG reporting standards in New Zealand for improved disclosures and accountability by companies.

## LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

There has been a lot of research on ESGD and company performance. There is no definitive evidence linking ESGs and financial performance (Eccles et al., 2014; Orlitzky & Benjamin, 2001) and the results are inconclusive. There have

been contradictory views on the relationship between ESGS and the financial performance of companies. Some researchers show a positive relationship while other researchers determine a negative or no significant relationship between ESGS and firm performance and market value.

### Positive relationship between ESGS and firm performance

This paper integrates stakeholder and resource-based theories to explore the ESGS and firm performance nexus. Most of the existing studies have used stakeholder theory and legitimacy theory to explain why ESGS are positively correlated with financial performance (Brooks & Oikonomou, 2018; Aboud & Diab, 2018; Yoon et al., 2018), asserting that managing stakeholder relationships is the key to improving financial performance. Stakeholder and legitimacy theories can provide insight into the motivations behind corporations' CSR and ESG efforts. Stakeholder theory asserts that shareholders are not the only parties who have a stake in a firm: creditors, employees, consumers, society and the environment are also affected. Harrison and Wicks (2013) highlight the factors associated with increasing stakeholder value and suggest that firms' financial performance is influenced by their relationships with stakeholders. Aboud and Diab (2018) believe that financial performance will improve when companies follow responsible social and environmental policies and practice good governance practices. Thus, a firm's commitment to society and the environment should align with the firm's sustainability goals, which are in the interests of all its stakeholders. Consequently, firms' financial results can be enhanced through good stakeholder relationships, resulting in an increase in shareholder value and competitive advantage (Bernardi & Stark, 2018; Li et al., 2018). Moreover, Yu and Zhao (2015) predict that corporate strategies and practices that incorporate environmental and social responsibility will reduce firm risk and enhance long-term value creation.

The legitimacy theory suggests that organisations must continually maintain their legitimacy, due to stakeholders' constant evaluation of their actions and decisions (Deegan et al., 2002). The theory suggests that organisations face ongoing pressure to maintain their legitimacy, as stakeholders are constantly evaluating the organisation's actions and decisions. Ghozali and Chariri (2007) assert that legitimacy is important for organisations, and the boundaries set by social norms and values, as well as reactions to these limits, reinforce the importance of analysing organisational behaviour by analysing the environment. Organisations that fail to maintain their legitimacy may face negative consequences, such as reduced support and co-operation from stakeholders, decreased access to resources and increased scrutiny from regulators. In a new institutional perspective, legitimacy theory states that investment in these activities is costly in the short term, but as a firm's legitimacy increases, it is positively evaluated over time.

In accordance with other researchers, Aboud and Diab (2018) provide evidence that a company with socially and environmentally responsible practices combined with good governance practices will improve its financial performance, strengthen its reputation and increase profitability. A recent study by Velte (2017) examines the impact of ESGS on financial performance and market value of companies listed on the German stock exchange for 2010–2014. In addition to increasing visibility, ESG performance increases profitability and valuation for firms. Additionally, Aouadi and Marsat (2018) argue that corporate social performance (CSP) can increase profitability and valuation for firms, potentially linking it to the ESG and profitability nexus.

### Negative relationship between ESGS and firm performance

Conversely, various studies have indicated that investing in sustainability activities increases financial performance costs for a company (Derwall et al., 2005; Hassel et al., 2005; Palmer et al., 1995; Semenova & Hassel, 2008), ESG practices negatively affect financial performance (Garay & Font, 2012; Revelli & Viviani, 2015) and ESG disclosures lead to higher costs and lower value for environmentally sensitive firms, which results in an economic disadvantage. According to Lee et al. (2016), ESG investment worsens financial performance, so firms with higher ESGS have lower capital costs. For the same reason, their study also suggests that firms with high ESGS might have lower equity costs. Similarly, other researchers have found negative associations between ESGS and financial performance (Brammer et al., 2006; Lee et al., 2016). Conversely, Galani et al. (2012) found that disclosures do not affect

profitability. Additionally, some authors conclude there is no link between ESGs and financial performance (Galema et al., 2008; Statman, 2006; Horváthová, 2010; Orlitzky et al., 2003). A study by Walley and Whitehead (1994) and Hamilton (1995) found that sustainability practices increased both operational and capital expenditures.

In their study, Duque-Grisales and Aguilera-Caracuel (2021) analyse Brazilian, Chilean, Colombian, Mexican and Peruvian companies' ESG performance over the period 2011–2015 and suggest a negative relationship between ESGs and financial performance. Based on a study by Galbreath (2013), it is difficult to estimate the relationship of ESGs with corporate performance. In general, these estimates don't explain how ESG performance impacts financial performance.

Considering the discussion so far, having a commitment to society and the environment aligned with sustainability objectives benefits stakeholders and strengthens a firm's financial performance. It is possible for companies to reduce risk and create long-term value by integrating environmental and social responsibility into their strategies. Hence, the research proposes the following hypotheses:

H1. There was a positive relationship between the ESGs and return on assets (ROA) of New Zealand companies during the Covid-19 pandemic.

H2. There was a positive relationship between the ESGs and return on equity (ROE) of New Zealand companies during the Covid-19 pandemic.

H3. There was a positive relationship between the ESGs and Tobin's Q of New Zealand companies during the Covid-19 pandemic.

## ESG practices and resource-based theory

Another view suggests that firms invest in ESG practices depending on the availability of financial resources (Aguilera-Caracuel et al., 2015; Allouche & Laroche, 2005; Waddock & Graves, 1997), positing that a firm's resources and capabilities, when effectively managed, can provide a sustainable competitive advantage because they are difficult for competitors to imitate or replicate. This can enable the firm to earn above-average returns in the long term. The theory also suggests that a firm's resources and capabilities must be aligned with the external market and industry conditions to be effective. A firm's resources and capabilities must be tailored to the specific needs of its customers and the demands of its industry to be successful (Li et al., 2018). Based on the resource-based theory, ESGs is associated with increased financial performance. A company investing in ESGs may gain both internal and external benefits through the development of new resources (Branco & Rodrigues, 2006).

When organisations have resources that can be reallocated, managers will be able to satisfy the demands of corporate stakeholders by taking more innovative actions (Voss et al., 2008). When resources are limited, firms are more likely to adopt conservative strategies, investing in what is considered fundamental to survival (Aguilera-Caracuel et al., 2015). Other researchers (Bassen & Kovacs, 2008; Tantalo & Priem, 2014) suggest that firms view ESG-related activities as a long-term strategy rather than short term.

In conclusion, resource-based views suggest that companies can achieve competitive advantage by leveraging their unique resources and capabilities, and ESG practices can be seen as investments in these resources. A firm's financial performance can be positively impacted by ESG initiatives when it has adequate resources and manages them effectively. Accordingly, the paper investigates how financial slack (FS) moderates the relationship between ESGs and company financial performance, and proposes the following three additional hypotheses:

H4. The availability of FS improved the relationship between ESGs and the ROA of companies during the Covid-19 pandemic.

H5. The availability of FS improved the relationship between ESGs and ROE of companies during the Covid-19 pandemic.



H6. The availability of FS improved the relationship between ESGS and the Tobin's Q of companies during the Covid-19 pandemic.

Table 1: Review of literature.

Harrison & Wicks, 2013	Highlight the key factors associated with increasing stakeholder value and suggest performance is influenced by their relationships with stakeholders.
Brooks & Oikonomou, 2018	Explain that ESGS are positively correlated with financial performance, emphasising the role of managing stakeholder relationships.
Yoon et al., 2018	Assert that ESGS are positively correlated with financial performance, highlighting the importance of managing stakeholder relationships.
Bernardi & Stark, 2018	Suggest that firms' financial results can be enhanced through good stakeholder relationships, resulting in increased shareholder value and competitive advantage.
Li et al., 2018	Emphasise the alignment of a firm's commitment to society and the environment with its sustainability goals, benefitting all stakeholders and improving financial results.
Yu & Zhao, 2015	Conclude that corporate strategies and practices incorporating environmental and social responsibility will reduce firm risk and enhance long-term value creation.
Deegan et al., 2002	Emphasise the necessity for organisations to sustain their legitimacy through ongoing scrutiny and evaluation.
Ghozali & Chariri, 2007	Discuss how legitimacy shapes organisational behaviour by analysing the surrounding environments and how these values and norms influence the organisation.
Aboud & Diab, 2018	Provide evidence that a company with socially and environmentally responsible practices, combined with good governance practices, will improve its financial performance, strengthen its reputation, and increase profitability.
Velte, 2017	Examined the impact of ESG performance on financial performance and market value of companies listed on the German stock exchange for 2010–2014 and suggest that ESG performance increases visibility and may also increase profitability and valuation for firms.
Aouadi & Marsat, 2018	Argue that corporate social performance (CSP) can increase profitability and valuation for firms, potentially linking it to the ESG and profitability nexus.
Palmer et al., 1995; Derwall et al., 2005; Hassel et al., 2005; Semenova & Hassel, 2008	Indicate that investing in sustainability activities increases financial performance costs for a company.
Brammer et al., 2006; Garay & Font, 2012; Revelli & Viviani, 2015	Found a negative relationship between ESG practices and financial performance.
Yoon et al., 2018	ESG disclosures lead to higher costs and lower value for environmentally sensitive firms, resulting in an economic disadvantage.
Lee et al., 2016	ESG investment worsens financial performance, and firms with higher ESG ratings may have lower capital costs.
Galani et al., 2012	Found that disclosures do not affect profitability, suggesting that ESG disclosures may not have a significant impact on financial performance.
Galema et al., 2008; Horváthová, 2010; Orlitzky et al., 2003; Statman, 2006	Conclude that there is no significant link between ESGS and financial performance.
Hamilton, 1995; Walley & Whitehead, 1994	Found that sustainability practices increase operational and capital expenditures for firms.
Duque-Grisales & Aguilera-Caracuel, 2021	Analysed ESG performance of companies in Brazil, Chile, Colombia, Mexico and Peru, and suggest a negative relationship between ESG and financial performance.

Galbreath, 2013	Found it difficult to estimate the relationship between ESGs and corporate performance, indicating that ESGs impact on financial performance is complex and not well-defined.
Aguilera-Caracuel et al., 2015	Suggest that firms invest in ESG practices depending on the availability of financial resources. A firm's resources and capabilities, when effectively managed, can provide a sustainable competitive advantage and be associated with increased financial performance.
Allouche & Laroche, 2005	Propose that firms' investments in ESG practices may depend on their financial resources.
Waddock & Graves, 1997	Suggest that firms' ESG investments can be influenced by their financial resources and capabilities.
Li et al., 2018	Emphasise the importance of aligning a firm's resources and capabilities with external market and industry conditions to be effective.
Branco & Rodrigues, 2006	Indicate that a company investing in ESGs may gain both internal and external benefits through the development of new resources, aligning with the resource-based theory perspective.
Voss et al., 2008	Suggest that when organisations have resources that can be reallocated, managers can take more innovative actions to satisfy corporate stakeholders.
Bassen & Kovacs, 2008	Propose that firms view ESG-related activities as a long-term rather than a short-term strategy, aligning with the idea that ESG investments are driven by resource availability and long-term considerations.
Tantalo & Priem, 2014	Suggest that firms consider ESG-related activities as part of a long-term strategy, indicating that ESG practices may be viewed as investments in resources and capabilities that contribute to sustainable competitive advantage.

## DATA AND METHODOLOGY

### Data

This study consists of a sample of publicly listed New Zealand companies from Refinitiv's DataStream database. The dataset includes publicly listed companies from 2017 to 2021. ESG ratings are based on one of the leading global, comprehensive ESG rating methodologies – the Refinitiv ESG scoring – which provides the most comprehensive coverage of New Zealand companies when it comes to ESG data in the process of assessing and scoring companies. Refinitiv calculates more than 500 ESG measures at the company level, of which 186 are the most comparable and relevant to each industry. Ten categories are used to group the metrics. A total of three pillar scores are derived from the category scores: environmental, social and corporate governance. A company's final ESG score (ESGS) reflects its ESG performance, commitment and effectiveness as reported by the company. A score between 0 and 100 is generated for each company based on the Refinitiv methodology. To investigate the impact of ESGs on financial performance, ten quarters of data have been taken, five before and five during Covid-19. The pre-Covid-19 period is from December 2017 to December 2019 and during Covid-19 is from March 2020 to March 2021. To eliminate the effect of outliers, all continuous variables were winsorised at the 5% and 95% levels. Companies involved in the industries of tobacco, alcohol, controversial weapons or gambling operations have been excluded from the research.

### Methodology

In this study, the fixed effects model was used to examine the effect of ESGs on companies' financial performance and market value over time. Control variables were included in the model to overcome omitted variables and endogeneity. In addition, the variance inflation factor (VIF) was estimated to determine multicollinearity among independent variables. If the VIF is 1, it means there is no correlation between independent variables, and if it is between 1 and 5, it means there is a moderately strong correlation, but it does not warrant attention. VIFs greater than 5 indicate a high correlation between variables, so regression analysis cannot be done.

For determining the effect of ESGs on financial performance and market value during Covid-19, three regressions were performed with ROA, ROE, and Tobin's Q as the dependent variables. The first set of panel data regression analysis was completed to examine the relationship between ESGs and dependent variables, namely the market value (Tobin's Q) and financial performance (ROA and ROE):

$$ROA_{it} = b_0 + b_1 ESGS_{it} + b_2 size_{it} + b_3 leverage_{it} + e \quad (1)$$

$$ROE_{it} = b_0 + b_1 ESGS_{it} + b_2 size_{it} + b_3 leverage_{it} + e \quad (2)$$

$$Tobin's Q_{it} = b_0 + b_1 ESGS_{it} + b_2 size_{it} + b_3 leverage_{it} + e \quad (3)$$

where ' $i$ ' represents the company ' $i$ ' in year ' $t$ '; ' $b_0$ ' is the constant term, and ' $e$ ' is the error term.

The next set of regressions was used to determine the change in the relationship between ESGs and the company's financial performance with financial slack (FS) as the moderating variable and to test the hypothesis that the impact of ESGs disclosure on company financial performance will be enhanced in companies with FS as a moderating variable. The analysis was performed using the same baseline regression model with FS as a moderating variable.

### Measurement of variables

The research assessed the performance of companies along three dimensions: financial, operational and market performance measured by ROE, ROA and Tobin's Q. Financial leverage and company size were used as control variables.

Based on previous studies, ROA has been considered one of the broadest measures of a company's profitability (Russo & Fouts, 1997). It is also an important method for measuring how effectively and efficiently a business generates revenue from its property. The second dependent variable is ROE, which measures how well companies invest and manage their capital (net worth).

The third variable, Tobin's Q, assessed the market value of each company (Aboud & Diab, 2018; El Ghouli & Kharoui, 2017; Li et al., 2018). The market value of companies has been measured by Tobin's Q in many studies, including studies done by Garg (2015), and Yu and Zhao (2015). This measure reflects past financial results as well as future developments (Li et al., 2018, Puri, 2022). The market capitalisation of a company is the sum of the book value of its total assets less its net worth divided by the book value of its total assets.

ESGS was the independent variable, which ranged from 0 to 100 according to how much ESG data companies disclosed. Bloomberg's ESGs has been widely used in academic literature (Manita et al., 2018). FS has been used as a moderating variable; this is measured by how much liquid asset a company has available to invest in various activities (Kraatz & Zajac, 2001). The amount of FS is calculated by dividing current assets by current liabilities.

The control variables were financial leverage and the size of the company. When investigating the impact of ESGs on financial performance, financial leverage and company size are key control variables (Andersen & Dejoy, 2011; Margolis et al., 2009). Several studies show that larger businesses produce better results due to economies of scale, more skilled managers, and formalised procedures (Naik, 2014). The log of a company's total assets is used to calculate its size. A company's leverage comes from using borrowed funds as leverage. The ratio is calculated by dividing the total liabilities by the net worth of the company. As leverage increases, financial institutions pay more attention to ESG information (Ghosh, 2017).

Table 2. Summary variables description.

Variable	Measurement
ROA	The ratio of a firm's net profit to total assets
ROE	The ratio of net income to shareholders' equity
Tobin's Q	The market value of equity plus the book value of debt divided by total assets
ESGS	ESG scores range from 0 to 100 based on data disclosed by companies
Financial slack	Current assets divided by current liabilities
Firm size	The natural logarithm of the book value of a firm's asset
Leverage	The ratio of a firm's total debt to the book value of its assets

## EMPIRICAL RESULTS

### Univariate analysis

Table 3. Summary statistics for all continuous variables before and during Covid-19.

Panel A shows summary statistics for all continuous variables before Covid-19. Summary statistics include mean, standard deviation, median, minimum and maximum values of all continuous variables.

Variable	Obs	Mean	Std dev	Min	Max
ROA	772	6.71	9.76	-17.36	31.63
ROE	772	8.86	17.00	-40.57	39.83
Tobin's Q	850	2.24	2.40	0.80	9.94
ESG score	792	35.75	15.18	16.23	70.83
Firm size	866	13.66	1.33	11.566	15.91
Leverage	731	24.94	16.25	0.61	69.31
Financial slack	635	4.09	8.09	0.22	33.64

Panel B shows summary statistics for all continuous variables during Covid-19. Summary statistics include mean, standard deviation, median, minimum, and maximum values of all continuous variables.

Variables	Obs	Mean	Std dev	Min	Max
ROA	313	5.44	10.77	-17.36	31.63
ROE	314	7.34	18.60	-40.57	39.83
Tobin's Q	336	1.98	2.13	0.80	9.94
ESG score	319	34.06	14.92	16.23	70.83
Firm size	342	13.81	1.359	11.56	15.91
Leverage	296	27.82	17.33	0.61	69.31
Financial slack	254	4.038	8.04	0.22	33.64

Panels A and B of Table 3 report the descriptive statistics of the variables used in our regressions. The mean value of ESG score is 35.7 before Covid-19 and 34 during the pandemic, which signifies that there has been a decrease in related activities during Covid-19. The mean of ROA, measuring financial performance before and during Covid-19, is 6.7, whereas 5.7 suggests a decline in the financial performance of companies during the pandemic. Along similar lines, the mean value of ROE before Covid-19 is 8.8 and during the pandemic it is 7.3, suggesting a decrease in the return on shareholders' equity. Tobin's Q mean values declined from 2.2 to 1.9 before and during the pandemic. Based on these results, we can conclude that the profitability and market value of firms has deteriorated during the pandemic, and there has been a notable increase in firms experiencing financial difficulties due to the Covid-19 pandemic. However, looking at the mean values in the sample, it can be concluded that the companies in the sample are profitable.

On average, companies' current ratio is 4 and 3.03 before and during Covid-19 respectively, which is a measure of short-term stability. Although there is a decline in the current ratio during Covid-19, the average values are positive, suggesting companies in the sample have a good short-term solvency position. On average, the leverage of the companies in the sample is 24.9 before the pandemic and 27.8 during the pandemic, suggesting an increase in borrowed funds during the pandemic. The average size of the companies in the sample is approximately 13.5 before and during the pandemic.

Table 4. Correlation matrix for all variables.

	ROA	ROE	Tobin's Q	ESGS	Firm size	Leverage	Financial slack
ROA	1						
ROE	0.77	1					
Tobin's Q	0.24	0.14	1				
ESGS	0.19	0.25	0.12	1			
Firm size	-0.02	0.17	-0.20	0.49	1		
Leverage	0.19	0.08	-0.31	0.00	0.12	1	
Financial slack	0.34	0.14	0.02	-0.14	-0.33	0.39	1

Table 4 reports the Pearson correlation matrix of the main variables. We find that a firm's financial performance ROA is positively correlated with ESGs. Additionally, according to the correlation matrix, ROE and Tobin's Q are positively correlated with ESGs. The coefficients for the independent variables are all below .80, which means that there is no significant correlation between them.

Furthermore, the test result of VIF indicates that the value between independent variables is 1.8, which confirms that the results are not biased by the problem of multicollinearity.

Table 5. Fixed-effects panel data regression.

VARIABLES	ROA	ROE	Tobin's Q
ESG score	0.011	0.001	0.001
	(0.335)	(0.919)	(0.364)
Firm size	-3.363***	-4.733***	0.414***
	(0.000)	(0.000)	(0.000)
Leverage	-0.0667***	-0.0305	-0.020***
	(0.000)	(0.000)	(0.000)
Constant	28.06***	32.28***	-5.063***
	(0.000)	(0.000)	(0.000)
Observations	766	783	775
R-squared	0.373	0.346	0.176

Note: Table 5 presents the estimation results of the fixed-effect panel regressions for three different outcome variables; ROA, ROE and Tobin's Q. All variables were winsorised at 5%. P-values are reported in parentheses. \*, \*\*, and \*\*\* denote significance at the 10%, 5%, and 1% levels, respectively.

Table 5 presents the empirical findings of the first set of panel regressions. The results indicate there is no significant relationship between ESGs and ROA, ROE and Tobin's Q, which is in line with several studies (Galema et al., 2008; Horváthová, 2010; Orlitzky et al., 2003; Statman, 2006). It is reasonable to assume that businesses were primarily focused on adjusting to the new normal and ensuring their survival due to the pandemic's unexpected and unprecedented circumstances. Covid-19 caused lockdowns, while ESG activities increased costs and lowered financial performance for companies. Hence, Hypotheses 1 and 2 are rejected.

Table 6. Fixed-effects panel data regression with moderating variable.

VARIABLES	ROA	ROE	Tobin's Q
Financial slack	0.049***	0.035***	0.003***
	(0.000)	(0.000)	(0.000)
Firm size	-3.661***	-5.140***	0.333***
	(0.000)	(0.000)	(0.001)
Leverage	-0.050***	-4.50E-05	-0.0241***
	(0.000)	(0.998)	(0.000)
Constant	21.83***	24.49**	-5.529***
	(0.000)	(0.013)	(0.000)
Observations	597	614	606
R-squared	0.488	0.415	0.333

Note: Table 5 presents the results of the fixed-effects panel regressions for three different outcome variables: ROA, ROE and Tobin's Q with FS as a moderating variable. All variables were winsorised at 5%. P-values are reported in parentheses. \*, \*\*, and \*\*\* denote significance at the 10%, 5%, and 1% levels, respectively.

Table 6 shows the results of a panel regression with FS as a moderating variable. Interestingly, the observed linkages between companies' ESGS and financial performance appear to have become significant with the appearance of the moderating variable. Based on the empirical results, ESGS is positively correlated with ROA, ROE and Tobin's Q when FS is the moderating variable. The results indicate that when surplus funds are available, companies invested in ESG-related activities during Covid-19, which improved their performance and market value. FS has a significant effect on the relationship between ESGS and the financial performance of New Zealand companies during Covid-19. The findings support the resource-based theory (Branco & Rodrigues, 2006), which states that ESG activities lead to internal resource development and increased corporate reputation. Additionally, the above results support stakeholder theory (Aboud & Diab, 2018; Brooks & Oikonomou, 2018; Yoon et al., 2018), which suggests that ESG activities satisfy the needs of stakeholders, enhance financial performance and increase the value of the company. Furthermore, the findings suggest that managers see sustainability activities as long-term investments and only invest in them if they have extra funds (Aguilera-Caracuel et al., 2017; Allouche & Laroche, 2005; Surroca et al., 2010; Waddock & Graves, 1997).

## ANALYSIS AND DISCUSSION

This study examined the effect of ESGS on financial performance and market value of companies in New Zealand during Covid-19. The results demonstrate that ESG activities did not affect either the financial performance or valuation during Covid-19, which indicates the negative impact of Covid-19 on New Zealand companies and supports the assertion that ESG activities will incur additional expenses, increase operational and capital expenditures (Hamilton, 1995; Walley & Whitehead, 1994), and cause financial disadvantage to companies (Palmer et al., 1995; Derwall et al., 2005; Hassel et al., 2005; Semenova & Hassel, 2008). These findings align with the studies that suggest a negative relationship between ESGS and firm performance (Brammer et al., 2006; Branco & Rodrigues, 2008; Lee et al., 2009). Furthermore, the findings confirm the sudden impact of Covid-19 on companies, where they had the responsibility of allocating their resources in the most efficient way to keep their businesses running rather than spending it on ESG activities. A practical justification for these findings is Covid-19's negative impact on New Zealand firms. Due to constrained resources and heightened uncertainty in a crisis like the pandemic, companies may prioritise financial survival over ESG initiatives.

Interestingly, in the presence of FS as a moderating variable, the relationship between companies and financial performance changes, becoming positive and significant. The results provide evidence that managers are more likely to support ESG investments or initiatives to meet the needs of their various stakeholders when they do not need to worry about repayment times or short-term expenses, and have sufficient financial reserves, which is line with the studies conducted by Aguilera-Caracuel et al. (2017), Allouche and Laroche (2005), Surroca et al. (2010), and Waddock and Graves (1997). Furthermore, the results suggest that companies view environmental investments as a long-term strategy rather than a short-term measure of attracting investors (Bassen & Kovacs 2008; Tantalo & Priem, 2014), and companies tend to implement ESG activities as part of their strategy to gain a competitive edge. In practice, these findings suggest that firms with high financial strength are stronger positioned to support ESG initiatives and investments.

Additionally, the findings are directly in line with stakeholders and legitimacy theory. Shareholders are concerned about the company's ESG activities, which proves the validity of the stakeholders theory (Harrison & Wicks, 2013). This is in accordance with studies conducted by Bernardi and Stark (2018), Yu and Zhao (2015), and Li et al. (2019), which have concluded that companies with socially and environmentally responsible practices combined with good governance enhance their market value and satisfy stakeholders. The theory also suggests that firms face ongoing pressure to maintain their legitimacy, as stakeholders are constantly evaluating the organisation's actions and decisions. Firms that fail to maintain their legitimacy may face negative consequences, such as reduced support and co-operation from stakeholders, decreased access to resources, and increased scrutiny from regulators. Consequently, the findings demonstrate how stakeholder and legitimacy considerations are relevant to guiding ESG practices, thereby strengthening the theoretical foundations of these theories (Deegan & Tobin, 2002; Ghazali & Chariri, 2007).



Furthermore, the paper contributes to the growing literature on sustainability by exploring how ESG disclosures influence firm performance, and how ESG practices increase resilience and adaptability during crises like Covid-19. Firms can foster healthy relationships with employees, customers, communities and investors by investing in ESG activities with surplus cash as sustainability concerns evolve. The empirical results provide a rationale for policymakers to implement the ESG framework so companies can update their ESGs and notify all stakeholders. Additionally, investing in ESG activities allows companies to stay ahead of regulatory changes and ensure compliance. The research also offers insight into how governments can create long-term incentives for companies to adopt ESG-related practices and design policies that mandate ESG disclosures and practices.

The research examined how the total ESGs affected the financial performance of companies during Covid-19, but it can also be replicated using individual ESG parameters to gain a wider perspective. The research model can be replicated for future studies using a wider range of countries and a larger sample size. The sample size was small as the research relied on data provided by companies that disclosed their ESGs.

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# Numerical Modelling Based on Large-Angle Oscillation Theory in Determining the Rotating Inertia of a Rotor Subjected to Frictions

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## Brief Research Report



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## ABSTRACT

This research discusses a numerical method used for determining the mass moment of inertia of a rotor that has been validated through laboratory tests. In this technique, the rotor is considered as a pendulum where an additional mass is mounted at the outskirts underneath the rotor. The equation of motion of this pendulum is then established, based on the oscillating unbalanced rotor, and the magnitude of the inertia is extracted from the free oscillating response. Nonlinear theory of pendulums with large-angle oscillation is applied to estimate the mass moment of inertia. While this mathematical theory considerably improves the result, the dry friction acting on the bearing of the rotor still creates a significant inaccuracy. This research proposes a resolution to alleviate this erroneous calculation by applying a remedy factor in interpreting the nonlinear response of the pendulum.

## KEYWORDS

Large amplitude oscillation, rotating inertia, coulomb damping friction

## NOMENCLATURE

Latin Symbol:

$c$	block parameter in the Simulink model, defined by Eq. 15
$D$	diameter of flywheel [m]
$d$	diameter of shaft [m]
$g$	gravity acceleration [ $\text{ms}^{-2}$ ]
$I$	mathematical definition of mass moment of inertia
$I_G$	mass moment of inertia at the centroid [ $\text{kgm}^2$ ]
$k$	block parameter in the Simulink model, defined by Eq. 16
$\tilde{k}$	stiffness in the mechanical vibration system [N/m]
$k$	radius of gyration [m]
$L$	length of simple pendulum [m]
$m$	block parameter in the Simulink model, defined by Eq. 14
$m$	variable of mass [kg]
$\tilde{m}$	mass in the mechanical vibration system [kg]
$M$	mass of flywheel [kg]
$\Delta m$	offset mass [kg]
$R$	distance from the additional mass to the axis of rotation [m]
$r$	variable of distance [m]
$T_o$	natural period (free oscillation of small angle without damping or friction) [s]
$T_{ex}$	nonlinear free oscillation period [s]
$T_p$	approximation of nonlinear free oscillation period by Parwani [s]
$th$	thickness of flywheel [m]
$t$	variable of time [s]



Greek Symbol:

$\theta$	degree of freedom in rotation; angular displacement [rad]
$\dot{\theta}$	angular velocity [ $s^{-1}$ ]
$\ddot{\theta}$	angular acceleration [ $s^{-2}$ ]
$\theta_0$	angular initial condition [rad]
$\mu$	coefficient of dry (Coulomb) friction
$\tau$	elapsed time [s]
$\emptyset$	angle between two slopes of amplitude response [rad]
$\omega_n$	natural frequency [ $s^{-1}$ ]

## INTRODUCTION

The increasing demand on the performance of rotating machines concerning acceleration, reliability and safety requires the engineers to determine accurately the magnitudes of mass moment of inertia. The application of this kind of component covers a large range: from electric vehicles, military/defence equipment and aerospace to robot arms.

In the state of design, the rotating inertia of a rotor can be determined using CAD software if all the dimensions of the rotor are known (Solidworks Help, 2017) however, for relatively old devices that need to be modified, the required input data is hard to establish. This information may not be specified in the product literature or available directly from the manufacturer. In the absence of this geometrical information, the mass moment of inertia can still be determined by performing certain tests on the machine. The familiar methods of experiment are the retardation test, the unwinding of a mass on the shaft of the rotor, and the pendulum test.

In the retardation test (Lekurwale & Tarnekar, 2012), the rotor of an electrical machine is rotated at a speed higher than the rated speed, then the rotor is allowed to run free until slowing down to a standstill. Kinetic energy is used to supply the rotational loss of energy, such that the rotating inertia can be extracted from the power consumed. The analysis was conducted numerically using Simulink-MATLAB.

Kassay and Grega (2020) use a string with a mass hanging on it that is wound on the cylindrical hub of a rotor to rotate the body. By releasing the rotor, as the weight goes down, a constant torque is exerted to the shaft and moves the rotor with a constant angular acceleration. By measuring the travelling angle for a certain interval, the acceleration of the rotor can be calculated and the rotating inertia eventually predicted.

In the same paper, Kassay and Grega propose another method, a pendulum system where a weight is connected rigidly to the hub of the rotor through a rod. By measuring the period of free oscillation, the rotating inertia can be calculated. From the equation of motion elaborated in this method, one may notice that the pendulum is a linear system. This method will be effective if the rod is considerably long and the friction damping is negligible.

In this paper the work focuses on the pendulum method with large-angle oscillations. This technique is beneficial, as the dismounting of the rotor and dismantling of the stator may significantly cost labour hours. A large angular displacement is introduced as a disturbance to start the oscillation, in order to overcome the friction on the bearing. In this technique, a nonlinear theory of pendulum with large-angle oscillation is employed. Parwani (2003) approximates the power series solution of a simple pendulum with large oscillation in a form of trigonometric function. Amrani et al. (2008) later revisited some techniques of approximation, with a range of angles related to the error range. In this paper they found that the error of Parwani's approximation is close to 0% for particular initial angular displacement of 90 degrees. Belendez et al. (2007) put their efforts into finding the exact solution of this nonlinear problem. It is interesting to note from their work that the angular frequency of oscillation depends on the value of the initial angle. Salas (2016) analysed large-angle oscillation with viscous damping. He obtained a good analytic solution, even suitable for a large damping coefficient. His results are valuable for validating purposes, especially in numerical modelling.

The use of a virtual lab is advantageous before conducting laboratory experiments. We commenced this research by establishing a numerical model in the MATLAB environment based on the equation of motion. Granda et al. (2018) simulated a large-angle pendulum using CAMPG software and also on Simulink-MATLAB. The Simulink model is constructed by taking a summation block, input-output, gain, integral and sine blocks, and arranging these into a block diagram. Both simulation results from Simulink and CAMPG agree with the analytical solution.

Looking into the effectivity of the numerical tool used by Granda et. al (2018), the numerical model is constructed on the platform of Simulink-MATLAB by adding into the system the features of nonlinearity and opposite sign block for large displacement and dry friction factor respectively. Considering the analysis from Amrani et al. on Parwani's approximation, the initial angular displacement of  $\pi/2$  radians is taken for this current work.

There is no research found so far that discusses the effect of dry friction on the large-angle oscillation pendulum. It is known that in linear vibration theory, Coulomb friction doesn't influence the free response frequency of the system. However, numerical exercises conducted in this work showed that the free response period is changed in large-angle oscillation in the presence of friction. Therefore, in order to find the natural period that is the core of the dynamic behaviour of the system, the free response of the experimental data needs to be remedied before applying Parwani's approximation.

## MODELLING

### Mathematical modelling

The sluggish behaviour of a solid cylindrical body to move on its rotational axis due to an external torque is defined mathematically as:  $I = \int r^2 \, dm$ . This magnitude determines the dynamic behaviour of the machine and plays an important role in the performance of a machine.

If one takes a cylindrical body, which has its rotational axis lying on a horizontal plane, and attach an additional mass to the surface in the position shown in Figure 1, this sluggish characteristic may perform an oscillating motion as a pendulum when a disturbance is applied to its equilibrium.

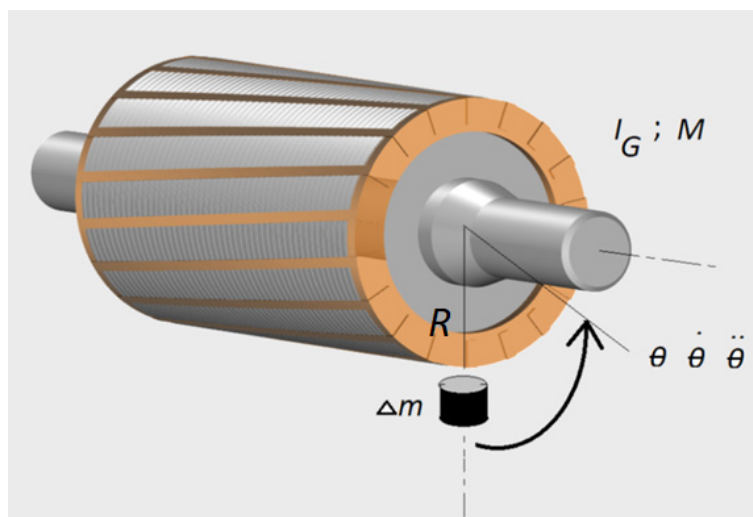


Figure 1. A rotor having mass  $M$  and mass moment of inertia  $I_G$ , is mounted with an additional mass  $\Delta m$  on its surface to perform a system pendulum with the degree of freedom  $\theta$ .

For a small-angle disturbance, the equation of motion based on Newton's Second Law can be expressed in a linear equation:

$$(I_G + \Delta m R^2) \ddot{\theta} + \Delta m g R \theta = 0 \quad (1)$$

From the linear theory of motion, the period of oscillation can be determined as the expression in Eq. 2, where the rotating inertia of the rotor will be calculated in terms of the additional mass.

$$T_0 = 2\pi \sqrt{\frac{I_G + \Delta m R^2}{\Delta m g R}} \quad (2)$$

Therefore, in a lab experiment, once the frequency of the free response is measured, the rotating inertia can be conveniently determined by calculation in terms of the magnitude and the distance of the additional mass to the centre of the rotation, shown in Eq. 3.

$$I_G = \left(\frac{T_0}{2\pi}\right)^2 \Delta m g R - \Delta m R^2 \quad (3)$$

However, in practice, Eq. 3 is not easy to apply, since in reality the bearing of the rotor always contains friction, which prevents a small/linear oscillating motion to occur. A large angle has to be initiated to produce an oscillating motion, but as a result it behaves differently, where a significant error will be introduced in the linear calculation. Therefore, for this purpose, a nonlinear theory concerning large amplitude and nonlinear damping needs to be developed.

Consider a simple pendulum, a mass hanging on a string with the length of string  $L$  and gravity  $g$ , where the mass is swinging freely with a large-angle oscillation. The equation of motion is written as:

$$\ddot{\theta} + \frac{g}{L} \theta \sin\theta = 0 \quad (4)$$

One may notice from the equation above that for a simple pendulum the magnitude of mass is neglected.

The free-oscillating period  $T_{ex}$  as a function of the natural period of linear oscillation can be expressed as a power expansion shown below:

$$T_{ex} \cong T_0 \left( 1 + \frac{1}{16} \theta^2 + \frac{11}{3072} \theta^4 + \frac{173}{737280} \theta^6 + \frac{22931}{1321205760} \theta^8 + \dots \right) \quad (5)$$

where the natural period  $T_0$  (one complete cycle for linear/small-angle oscillation) is expressed as:

$$T_0 = 2\pi \sqrt{\frac{L}{g}} \quad (6)$$

Parwani (2003) proposed to approximate the series as:

$$T_P = T_0 \left( \frac{\sin\left(\frac{\sqrt{3}\theta}{2}\right)}{\left(\frac{\sqrt{3}\theta}{2}\right)} \right)^{-0.5} \quad (7)$$

Compared with the other existing approximations, Parwani's (2003) solution is chosen in this work as, for the initial condition of 90 degrees, the approximation gives an error close to zero (Amrani et al., 2008).

For the case of large-angle oscillation of the rotor shown in Figure 1, the moment at the axis of rotation due to the weight of the additional mass  $\Delta m$  and the moment arm of  $R \sin(\theta)$  is expressed as:

$$M_{\theta, \Delta m} = \Delta m g R \sin(\theta) \quad (8)$$

and by considering this moment in the principle of equilibrium of Newton's law shown in Eq. 1, the equation of motion now can be expressed as Eq. 8, which is comparable to Eq. 4

$$(I_G + \Delta m R^2) \ddot{\theta} + \Delta m g R \sin(\theta) = 0 \quad (9)$$

where the natural period of oscillation of the rotor  $T_0$  can be calculated using Eq. 7 if the free response period  $T_{ex}$  can be measured from the experiment.

In reality, the measured signal of the free response is contaminated with the effect of friction acting on the bearing of the rotor. This erroneous signal has to be treated before applying Parwani's approximation.

The moment exerted by the friction at the axis of the rotation depends on the weight of the rotor  $Mg$ , the friction coefficient of the bearing  $\mu$  and the radius of the shaft  $D/2$ . The magnitude of the moment is constant and the direction is in the opposite of the motion. The moment is expressed as:

$$M_{\theta, \mu} = \mu M g r \operatorname{sgn}(\dot{\theta}) \quad (10)$$

where  $\operatorname{sgn}$  is signum function, it is defined as:

$$\operatorname{sgn}(x) = \begin{cases} 1 & \text{if } x < 1 \\ -1 & \text{if } x > 1 \\ 0 & \text{if } x = 0 \end{cases}$$

Consider now the case where a rotor, with the existence of dry friction on the bearing, is subjected to a large initial angular displacement. By incorporating the large angle and the friction factor into the equation of equilibrium of moment acting at the rotational axis, the equation of motion can be expressed as:

$$(I_G + \Delta m R^2) \ddot{\theta} + \mu M g r \operatorname{sgn}(\dot{\theta}) + \Delta m g R \sin(\theta) = \begin{cases} 0 & \text{for free response} \\ F(t) & \text{for forced response} \end{cases} \quad (11)$$

where  $F(t)$  is the external load.

The relationship between mass and mass moment of inertia is given as:

$$I_G = M \times k^2 \quad (12)$$

By contemplating on the complete mathematical model shown as Eq. 11, one may state that if mass and mass moment of inertia are known and the other parameters – i.e., additional mass and its location from the centre of rotation, the radius of gyration of the rotor, friction coefficient and diameter of shaft – are given, under certain disturbance (initial conditions or external load), the oscillating response can be determined.

The reverse of this statement is also true; if the oscillating response of rotor can be measured accurately while all the parameters are given, then the mass and the mass moment of inertia of the rotor can be determined.

## NUMERICAL MODELLING

In this work, the dynamic system of the rotor is constructed on the platform of Simulink-MATLAB based on Eq. 11, and the simulation in time domain is processed using ode45 default solver (MathWorks R2023a, 2023).

In Simulink, the block of differentiation is prone to numerical errors and tends to produce numerical noise, therefore will be avoided in this work. From the equation of motion, the inertial load is expressed as the total sum of gravitational, frictional damping and the external load as shown by Eq. 11. By dividing the inertial load with the term of inertia ( $I_G + \Delta mR^2$ ), the magnitude of angular acceleration can be expressed explicitly, as shown in Eq. 13.

$$\ddot{\theta} = \frac{-\mu Mgr \operatorname{sgn}(\dot{\theta}) - \Delta mgR \sin(\theta) + F(t)}{(I_G + \Delta mR^2)} \quad (13)$$

A block diagram representing the equation can be constructed, as shown in Figure 2. Now the signal of angular acceleration is ready to be integrated to become angular velocity, and by another integration to become angular displacement.

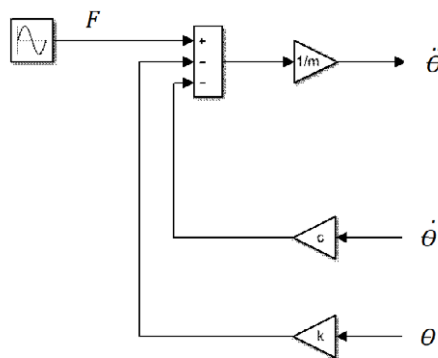


Figure 2. Block diagram explaining the generation of pendulum inertial load as a sum of external load, gravitational and damping load.

The parameters  $m$ ,  $c$  and  $k$  cited in the blocks are defined as:

$$m = (I_G + \Delta mR^2) \quad (14)$$

$$c = (\mu Mgr) \quad (15)$$

$$k = (\Delta mgR) \quad (16)$$

The equation of motion is fulfilled by feeding back these two terms, as presented in Figure 3. One may observe that the block diagram doesn't contain any differentiation block, even though the mathematical model is a differential equation. The block diagram arrangement contains both nonlinearities of dry friction and large angular displacement. The initial displacement of 90-degree angle is given as an input to start the simulation.

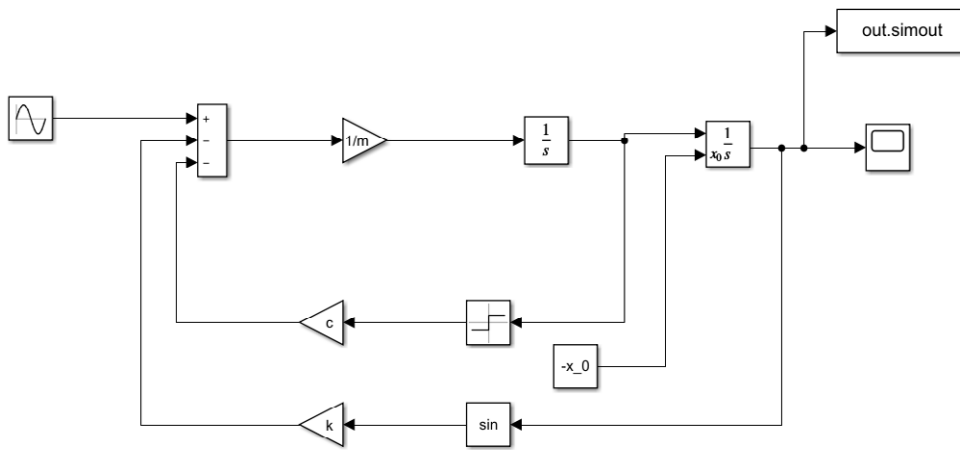


Figure 3. Block diagram of pendulum with two nonlinear factors, i.e., large amplitude and dry friction.

A numerical exercise is conducted on a model of a flywheel with hypothetical data as shown below:

- Mass of the flywheel,  $M = 10.0$  kg
- Mass moment of inertia of the flywheel,  $I_G = 0.0405$  kgm<sup>2</sup>
- Dry friction coefficient,  $\mu = 0.0015$
- Additional mass,  $\Delta m = 0.2$  kg
- Shaft radius,  $r = 0.023$  m
- The distance from the rotational axis to the additional mass,  $R = 0.1$  m
- Initial angular displacement,  $\theta_0 = \pi/2$  radians
- External load,  $F(t) = 0$ .

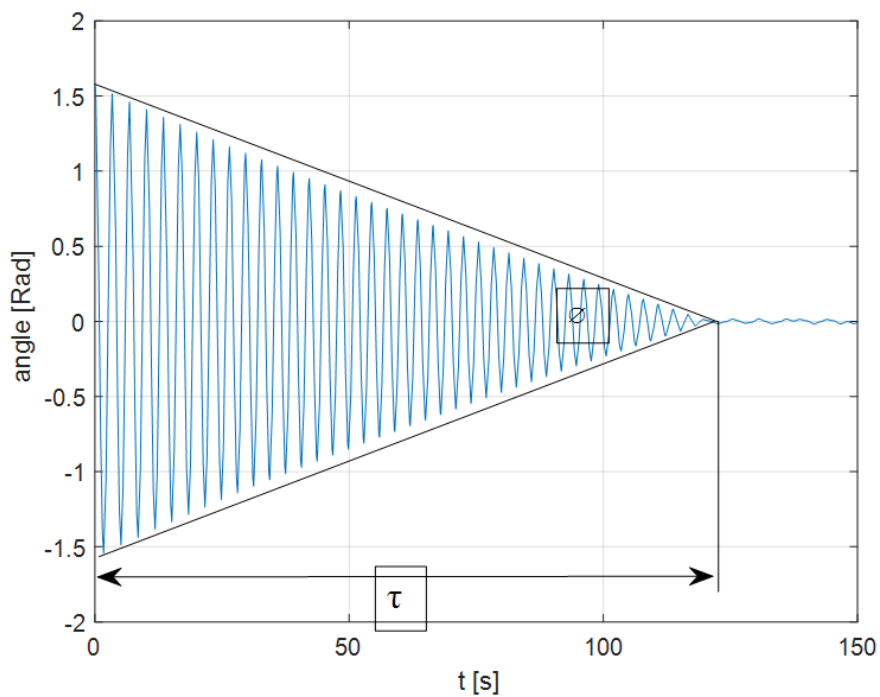


Figure 4. Free response of an oscillation with initial angle of  $\pi/2$  rad for  $\mu = 0.0015$ ,  $\theta$  is an angle between the two slopes of the response. This numerical simulation is conducted on a hypothetical model of a 10 kg solid steel disc.

By carrying out some numerical simulations for a range of friction coefficients, one may observe that the reducing periods of free response vary proportionally with the rise of the friction coefficient. It can also be observed that the descending period appears comparative with the slope of the amplitudes, as shown in Figure 4. The oscillating response of the large angle of rotor pendulum is quite similar with the case of linear vibration with coulomb damping (Moore et al., n.d.).

With these numerical substantiations, it is suggested that the expression of the nonlinear period without friction  $T_p$ , (the one to be processed through Parwani's approximation, to have the natural frequency of the system) is to be remedied as shown in Eq. 14, below:

$$T_p \approx \frac{\theta_0}{\theta_0 - \phi} \times T_{ex} \quad (14)$$

$$\phi = \tan^{-1} \left( \frac{2\theta_0}{\tau} \right) \quad (15)$$

where for a truncated data with long elapsed time the angle of is be approximated as:

$$\phi \approx \text{ascending slope} - \text{descending slope} \quad (16)$$

It should be noted that the units of  $T_p$ ,  $T_{ex}$  and  $\tau$  are in seconds and  $\theta_0$  and  $\phi$  are in radian.

In observing the amplitude response in Figure 4, where the slope is not entirely linear as expected in the small-oscillation case, one may note that the frictional damping is little bit higher compared to the linear case. Therefore, the damping extracted from the free response has to be corrected as well.

## LABORATORY EXPERIMENT

### Equipment

The equipment selected to undertake this initial practical approach, illustrated in Figure 1, consisted of the following items:

- The rotor – a simple disc made from steel alloy mounted on a steel shaft and supported by bearings.
- Diameter,  $D = 0.18$  m
- Thickness,  $th = 0.05$  m
- Density,  $\rho = 0.283$  lb/in<sup>3</sup> (= 7833 kg/m<sup>3</sup>) (AIAA, 2003)
- An offset mass – a simple 200 g mass attached to the rotor by means of Blu-Tack.
- The distance from the centroid of the offset mass to the axis of rotation,  $R = 0.1$  m
- A digital timer – a smart-phone timer with stopwatch display
- A highspeed camera – theoretically capable of recording images of a reasonable resolution at a frame rate of up to 120 fps.
- Online protractor (n.d.).





Figure 5. Experiment setup.

## PROCEDURE

1. The mass was mounted on the outer edge of the rotor and affixed with Blu-Tack.
2. After setting the mass at an angle of  $180^\circ$  a reference mark was then made diametrically opposite to the mass at  $0^\circ$ , this was the reference point for measurements to be taken.
3. The camera was then mounted on a tripod and placed at a point where the rotor filled the frame.
4. The timer was then placed adjacent to the rotor and within the frame of the camera.
5. After starting the timer, and then the camera, the rotor was released from its initial position (mass at  $180^\circ$ ) and allowed to oscillate under the influence of the mass. Oscillation continued up to the maximum recording duration time of the camera, allowing roughly twelve oscillations to be captured.
6. This procedure was repeated a number of times in order for a moderate amount of data to be collected.

## Data collection

A number of runs were made from which three were selected for analysis, and the images from these three resulting runs were then downloaded to a computer. While the images collected for each run numbered 100, the majority of these images were not required for analysis, and the frames of interest (the target frames) were only those taken at the change point of oscillation – the  $0^\circ$  and  $180^\circ$  points of the reference marker.

In order to show that the correct target frame had been selected for analysis, when removed from the full photographic data set, three frames were selected at each datum point – the advancing frame, the target frame and the retarding frame. This gave a total useful frame count of 36 for each run, with the resulting 36 images being saved to a separate directory for analysis.

After selection of the required images had been completed, the target frames were then analysed by means of a digital protractor overlay on a computer screen. For each target frame, the angle was recorded along with the time display taken from the digital timer, and these values were entered into a spreadsheet for numerical analysis.

## Data processing

The other parameters were the same as the hypothetical model, with the exception of the dry friction coefficient, which was required to be determined from the experimental data.

The mass of the rotor was calculated by using the geometrical data and the density of material, while the mass moment of inertia was calculated using Eq. 12, where the radius of gyration is  $D^2/8$ . As a result, the mass and the rotating inertia were 9.966kg and 0.04036kgm<sup>2</sup> respectively. These two values were made as the standard in defining the accuracy of the method.

From the multiple experiments conducted (to ensure the consistency of the measurements), one sequence of the experimental data is presented in Table 1, below, and represented as an oscillating curve in Figure 5.

Table 1. Experimental data.

time [s]	angle [rad]
0	-1.588249619
1.79	1.396263402
3.41	-1.553343034
5.2	1.343903524
6.83	-1.535889742
8.52	1.308996939
10.29	-1.483529864
11.93	1.256637061
13.45	-1.448623279
15.14	1.221730476
16.85	-1.396263402
18.36	1.169370599

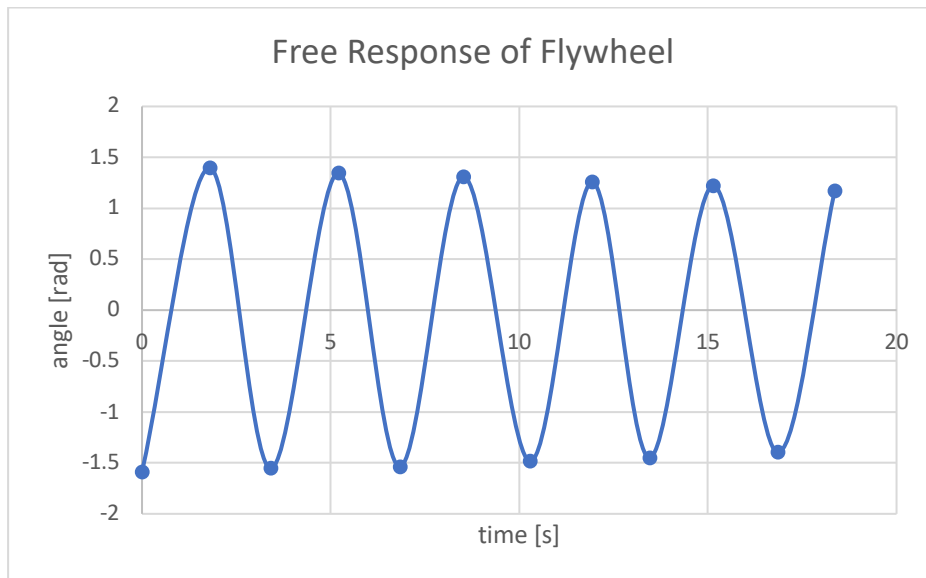


Figure 6. Graph plotted from the fragmental raw data of the experiment, where the initial condition is  $-\pi/2$  rad.

The graph in Figure 6 is actually a signature of the system that, together with the value of the offset mass, reflects its dynamic characteristics, i.e., the natural period, damping coefficient and rotating inertia.

By conducting the calculations using the expressions of Eq. 15, Eq. 14, Eq. 7 and Eq. 2 in this particular order, the mass moment of inertia (together with the mass) can be estimated, even without knowing beforehand the coefficient of friction. The accuracy of this method can be determined by comparing with the actual specimen data. The accuracy can also be verified by numerically reconstructing the signal response (using the Simulink model) and comparing with the experimental response data.

In calculating Eq. 15, as the elapsed time is relatively long, the angle  $\theta$  is approximated by the sum of the ascending and descending slope angle of the amplitude response, which is equal to  $39.834 \times 10^{-3}$ .

The results of the calculations in the above procedure are presented in Table 2.

Table 2. Data-processing results.

	Mass [kg]	Inertia [kg m <sup>2</sup> ]	Error [%]
Using linear theory	13.2117	0.0535076	32.56
Parwani without remedy	9.35893	0.0379037	6.09
Parwani with remedy	9.68135	0.0392095	2.86

## DISCUSSION

It is also interesting to see the damping factor that can be extracted from the experimental data by certain practice. In the linear theory of mechanical vibration, Moore et al. (n.d.) show that, for the case of free vibration with Coulomb damping, the amplitudes response is linear rather than exponential, where the gradient is equal to:

$$\text{slope} = \frac{2\mu\tilde{m}g\omega_n}{\pi k} \quad (16)$$

where  $\tilde{m}$  and  $\tilde{k}$  are mass and stiffness of a one-degree of freedom mechanical system, while the equation of motion expresses as:

$$\tilde{m}\ddot{x} + \mu mg \operatorname{sgn}(\dot{x}) + \tilde{k}x = 0 \quad (17)$$

where  $\ddot{x}$ ,  $\dot{x}$  and  $x$  are linear displacement, linear velocity and linear acceleration respectively.

The coefficient of friction damping can be extracted as:

$$\mu = \frac{\pi \tilde{k} \operatorname{slope}}{2 \tilde{m} g \omega_n} \quad (18)$$

In case of angular motion of the rotor, by considering the equation of motion shown in Eq. 11 and referring to Eq. 18, the damping coefficient of friction can be stated similarly as:

$$\mu = \frac{\pi k \operatorname{slope} \times R}{2 m g \omega_n} \quad (19)$$

where  $m$  and  $k$  are defined in Eq.s 14 and 16 respectively, and  $\omega_n$  is the natural frequency that can be expressed in natural period using Eq. 20:

$$\omega_n = \frac{2\pi}{T_0} \quad (20)$$

The coefficient of friction  $\mu$  can be determined using Eq. 19 and corrected due to large-angular oscillation in the same way when the natural period is calculated. In this experiment, after being multiplied by the factor of remedy, the coefficient is equal to 8.91E-04.

When provided with the results in Table 2, the signal of response can then be reconstructed using the Simulink model in Figure 3 for further verification regarding the model validation. The reconstructed signal, as shown in Figure 7, is now ready and can be compared with the experimental data shown in Table 1 and Figure 6, from where the accuracy can be evaluated.

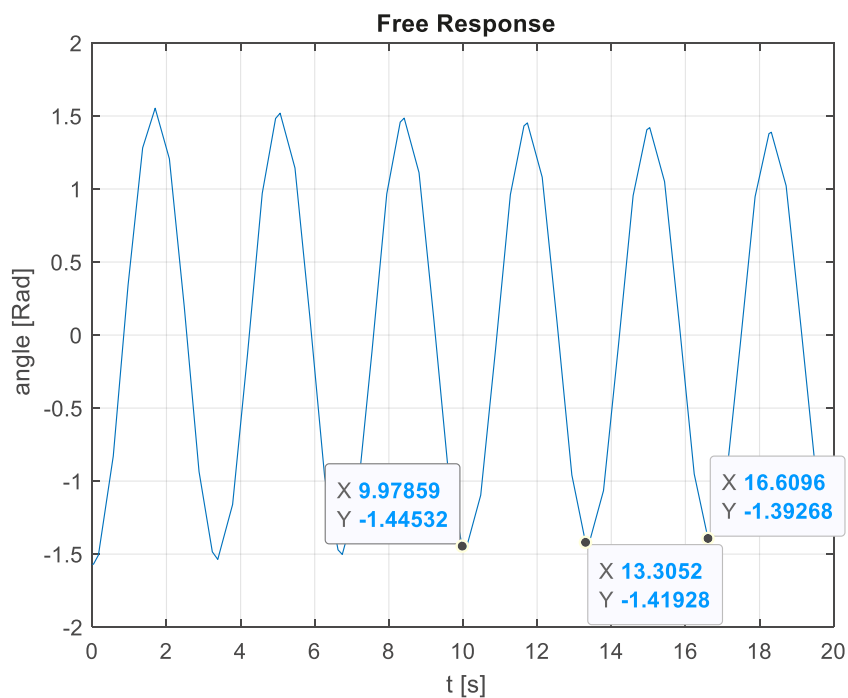


Figure 7. Reconstruction of the response signal using the Simulink model, where the amplitudes (Y) and the time (X) are compared with the raw data, the curve in Figure 5 and Table 1.

Another possible source of errors may come from the experiment itself, in terms of the limitations, assumptions and the procedure.

### Limitations and assumptions

The initial setup, as described above, has a number of limitations in both its application and data-analysis techniques. It was primarily undertaken in order to obtain a set of starting data to check methodology and establish a basis for a more robust investigation.

The first limitation noted was that the theoretically achievable frame rate of the recording device was not achievable due to the lighting conditions that were being worked under. The actual frame rate achieved was closer to five frames per second, with this resulting in errors in identifying distinct reversal points of the rotor with absolute certainty.

The second limitation noted was related to the on-screen measuring of the angles. The measuring device was effective but crude, very much dependent on the skill of the operator in setting datum points from which to measure.

### Procedural improvements

Despite the crude nature of the setup, a set of working figures was able to be established that were suitable for making initial calculations. However, moving forward, a more precise set of measurements will be required, using a setup that would ideally remove the human element from data collection.

While exactly how this will resolve has not yet been established, it is hoped to utilise a setup of digital photo-gates, along with a fixed setup for other equipment, allowing for the confident repetition of the experimental conditions over time.

## CONCLUSION

A technique to measure the mass moment of inertia of a rotor can theoretically be done by considering the rotor together with an offset mass on its surface as a pendulum, by measuring the natural period of oscillation. However, in practice this method cannot be realised, as the mechanical bearing always produces friction that prevents proper measurement of the natural period, unless a large-angular displacement is given as an initial condition. A new experimental technique based on large-angular oscillation to determine the mass moment of inertia of a rotor with the presence of dry friction has been established. This theory of nonlinear pendulum has proven its effectiveness in determining the natural period of free oscillation without damping. As the numerical exercises show, in large-angular displacement, the free response period varies with the change in frictional damping coefficient, instead of being constant, as expected in linear theory. In this experimental technique, a correction is applied to the damped free-response data before the process, to estimate the natural period, using Parwani's approximation and eventually the mass moment of inertia. If the figure of the rotor is analytically regular, as a simple flywheel of a disk where the radius of gyration is known, the mass then can be calculated based on the estimated rotating inertia. In practice, very often the appearance of the real rotor is not simple, and then it can only be measured by its weight. The sources of error in this technique come from the remedy coefficient itself, i.e., a correction factor before applying Parwani's approximation, the numerical accuracy in the process of simulation, and from the process of data collection.

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