EVALUATING *TIAKI:* AN EDUCATIONAL GAME ON PEST MANAGEMENT

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NEW ZEALAND'S BIOLOGICAL HERITAGE
Ngā Koiora Tuku Iho

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Evaluating *Tiaki*: An Educational Game on Pest Management

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ABSTRACT

This project evaluated *Tiaki*, a serious board game designed to educate players on pest management in Aotearoa New Zealand. *Tiaki*, developed with conservation experts, fosters discussions on biodiversity protection and ethical pest control. We interviewed the creators behind *Tiaki* and conducted 11 playtesting sessions, including pre- and post-game surveys to assess the game's effectiveness in enhancing player knowledge and engagement. Results found that 53% of players reported increased familiarity with pest control methods. Players reported a broader understanding of the diversity of ethical perspectives. Recommendations include suggestions for areas for game improvement involving rule clarity, card ambiguity, and pest-related context to enhance *Tiaki*'s impact as an educational tool.

EXECUTIVE SUMMARY

Introduction

Invasive species pose a great threat to global biodiversity, with specific impacts on native ecosystems and agriculture. Aotearoa New Zealand is particularly vulnerable, as introduced predators have devastated its native flora and fauna, as well as disrupted its ecological balance. The ecosystem has a 1,000-year history with pests that prey on local species from English and Polynesian colonizers who intentionally and unintentionally introduced them. Introduced insects, rodents, and larger mammals pose a significant threat of decline or extinction to the fragile and isolated native species of Aotearoa.

In response, the Biological Heritage research program has prioritized public education and engagement in pest control efforts. One approach to this mission is through serious games – games designed with an educational purpose – to facilitate discussions, enhance understanding, and promote community participation in conservation initiatives.

Tiaki is a serious game designed to be a new tool in pest control education. Dr. Ocean Mercier, Pat van Berkel, and other biodiversity experts in collaboration with the Biological Heritage research program developed the game. *Tiaki* targets New Zealand residents, particularly those with a stake in pest control, to highlight different strategies for control and their importance to the country's biodiversity. The goal of this project was therefore to evaluate the *Tiaki* game's effectiveness as an educational tool on the topic of pest control choices. To achieve this goal, we identified three objectives. The first objective was to understand the justification for using serious gaming for pest control education. Our second objective evaluated how the design mechanics and components of *Tiaki* influence the user experience, playability, and engagement. Our third objective measured and assessed the impact of the *Tiaki* board game on participant knowledge and interest. Our findings revealed that opportunities for improvement and clarity in the game would enhance impact.

The foundations of *Tiaki*

The term tiaki refers to the Māori concept of caring and protecting for people, place, or culture, and is a core principle for many in Aotearoa New Zealand. The

development of *Tiaki* aligns with New Zealand's Predator Free 2050 initiative, a nationwide goal to eradicate invasive predators to restore native ecosystems (Predator Free 2050 NZ, 2025). The game creates a collaborative environment, players can explore the effectiveness, ethical implications, and future possibilities of different management strategies. The game further encourages critical thinking by incorporating contemporary perspectives on pest control derived from mātauranga Māori, a framework including conservation values that influence New Zealand's environmental management following the integration of the Treaty of Waitangi.

Dr. Ocean Mercier, Pat van Berkel, and other biodiversity experts developed *Tiaki*, a serious board game designed to educate New Zealand citizens about pest management strategies. The game presents real-world scenarios and an assortment of control methods, including trapping, Mātauranga (Māori knowledge), poison, te ira tangata (community-driven efforts), and gene technology.

We gathered insights from ExpandED, a serious game used in medical education, to provide us with a comparative framework for understanding the effectiveness of game-based learning. This game simulates the pressure of working and managing an emergency department (ED) shift with a variety of medical professionals. Further, these insights contributed to a better understanding of *Tiaki* gameplay and mechanics.

Tiaki invites players to work together to strengthen the mauri (life force) of Aotearoa by protecting the balance of taonga (treasures) species and managing pests, such as mice, stoats, or wasps. The game presents real-life scenarios, with each player receiving method cards to help address the challenges. Method cards display different forms of pest control which players use to complete scenarios and challenges. These method cards include trapping, mātauranga (Māori knowledge), poison, te ira tangata (the human element), and gene-tech. Scenario and challenge cards provide different pest-related problems that players must solve using their method cards.

When players complete the scenarios, they receive taonga (treasure) tokens, which strengthen the mauri; however, if the players do not control the challenges, they place a pest token on the board. The game ends when players collectively receive six taonga tokens, resulting in a team win, or six pest tokens, resulting in a loss. **Refer to Figure E1** for game components and instructions.

Component Name	Purpose
Tiaki Game Board	The playing field of *Tiaki* where players place their drawn Scenario card, Challenge card, and desired Method cards during gameplay. Taonga and pest tokens are placed on the board to track the game's progress.
Rule Book	The guidelines for the aim, set-up, and gameplay of *Tiaki* are found here for players to follow.
Method Card	Strategy cards, distributed to players throughout gameplay used to respond to the Challenge and Scenario cards.
Challenge Card	A card drawn in alignment with a Scenario card, posing a pest challenge that must be controlled throughout gameplay with Method cards. If no action is taken, players gain a pest token.
Scenario Card	A card drawn to strengthen mauri. Upon achievement through Method cards, players gain taonga tokens.

Component Name	Purpose
Taonga Token	Tokens gained and placed on the board upon achievement of Method cards. The game is complete (won) with a gain of six taonga tokens.
Pest Token	Tokens gained when Method cards are replaced throughout gameplay. The game is complete (lost) with a gain of six pest tokens.

Table E1: Game Component Glossary

Approach to data collection

Our study focused on three primary objectives:

1. Understand the justification for using serious gaming for pest control education.
2. Evaluate how the design mechanics and components of *Tiaki* influence the user experience, playability, and engagement.
3. Measure and assess the impact of the *Tiaki* board game on participant knowledge and interest.

We conducted semi-structured interviews with key stakeholders in *Tiaki*'s creation, including the game designer, graduate student Tere Porter-Rawiri, and one of the game developers, Ellie Tuckey, Co-Founder of the design firm Third Studio. Our discussions provided insight into the game's educational intent, design motivations, and mechanics.

We conducted participant observation and playtesting sessions. A participant observation session first included our team setting up the game, reading the rules, and taking initial notes about our expectations. We then played the game, making sure to individually note any points of confusion or interest and reflected on our game experience. In public playtesting sessions, we recruited individuals with diverse backgrounds, including students, conservational advocates, pest management experts, and avid board game players. We hosted 10 sessions with 32 playtesters in groups of 2, 3, 4, and 5.

Our playtesting sessions took place in Ngā Mokopuna, the Māori studies building at Victoria University of Wellington, at Caffeinated Dragon Games, and in a participant's home in Upper Hutt with conservation advocates. Video and audio recording captured the entirety of the sessions, capturing player discussion and hand movement of game components. A member of our team led the playtest sessions to guide participants through the

process while encouraging players to discover and understand the rules on their own. Another member of our team acted as a scribe throughout sessions, noting timestamps of key moments in interactions, engagement, and points of confusion throughout the session to ensure seamless data capturing.

To assess the impact of *Tiaki* on participants, we used quantitative and qualitative analysis in pre- and post- game surveys. We used Likert scale questions to capture shifts in knowledge levels as well as ranking player experience relating to mechanics of *Tiaki*. Open-response questioning allowed us to capture a human element and additional results as well as recommendations.

Results

The interviews with *Tiaki*'s designer, Tere Porter-Rawiri, and developer, Ellie Tuckey, reveal key insights into the design rationale. Tiaki creators designed the game to foster collaboration and discussion, focusing on real-world pest control methods. Our discussions provided insight into the game's educational intent, design motivations, and mechanics. Tere explained the thinking behind the open-ended nature of the game.

"We wanted the game to be open-ended because that's the reality of it. Because no one has put rules on [gene tech] yet". -Tere Porter-Rawiri

Tiaki's developers chose the game's interactive nature over traditional educational formats to encourage a deeper, two-way exchange of information. While initially considering a more complex game design, the game design team opted for a simpler structure to ensure accessibility and maintain focus on the educational content.

Through participant observation and playtesting sessions, the evaluation assessed how design mechanics such as card ambiguity and the game's overall length influenced gameplay. While players initially struggled with certain aspects, including distinguishing between scenario and challenge cards, engagement increased once players understood the mechanics. Despite some confusion, the game encouraged discussions and critical thinking, with players actively sharing ideas and strategies. Survey results indicated that most players found the game's written content interesting and felt more knowledgeable about pest control after playing. Notably, many players also reflected on the ethical implications of pest control methods, particularly around gene technology and poisons.

Figure E2 illustrates player response to question 1 in both the pre- and post-game surveys. Using the Likert scale, question 1 asked "How familiar are you with pest control methods in Aotearoa New Zealand?" Of the 32 players that participated in the playtesting, 53% had an increase in familiarity after playing *Tiaki* with an average point increase

of 0.86 out of 5 total points. However, a ceiling effect affected these results, as only one participant who answered "quite familiar" or "very familiar" had an increased response in the post-game survey.
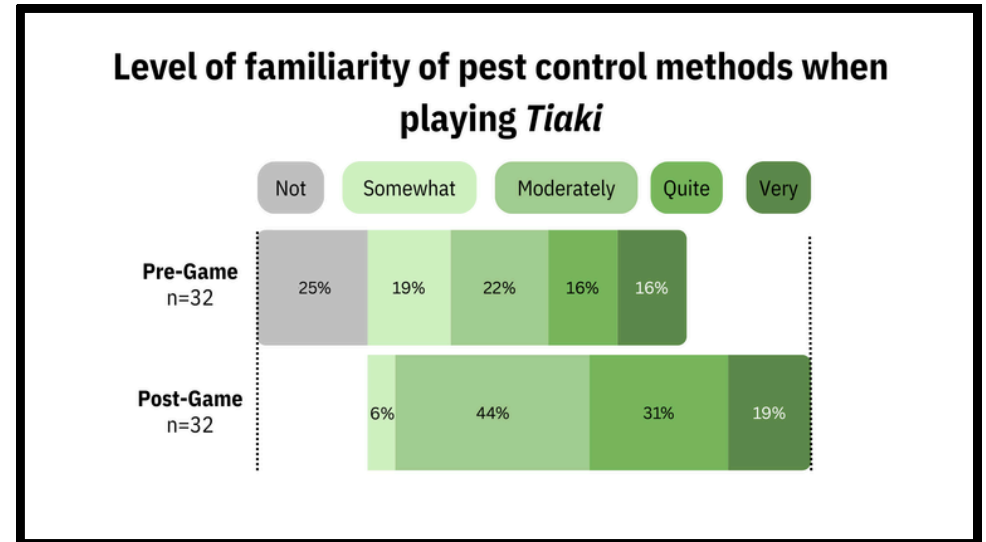

Figure E1: Graph displaying survey results of overall pre- and post-game familiarity level

Open-response questions highlighted that *Tiaki* successfully prompted players to consider different perspectives on pest control, which is central to the game's educational purpose. Nine players noted that they gained new perspectives on pest control, particularly regarding ethics in gene technology and poison use. However, there were areas for improvement, particularly in terms of rule clarity and card ambiguity. When coding two post-game survey question responses, the theme of card ambiguity

was mentioned by 11 participants, and the theme of rule clarity was mentioned by 8 participants. **See Table E3** for coding responses.

These issues occasionally disrupted the flow of the game but also sparked engaging debates and problem-solving among players. Despite these areas for improvement, the overall reception of *Tiaki* was positive, indicating its potential as a valuable tool for educating players on complex environmental issues through interactive, collaborative gameplay.

Category	Total
Card Ambiguity	11
Background Context	3
Rule Clarity	8

Table E2: Coding Table for post-game survey Q.12-13

Recommendations

Based on our analysis and playtesting of *Tiaki*, we propose several improvements to enhance the game's educational value and gameplay experience:

1. Adding more visual aids to the rulebook, such as images of card placement and action sequence.
2. Adding glossaries to the rulebook that provide context on the pests featured in *Tiaki*, including their environmental impact and real images, and one for pest control strategy categories used in method cards.
3. Including bolded text on all method cards to identify which pest populations they can combat in challenges.
4. Including bolded text on open-ended challenge cards to have the table reach a unanimous decision during gameplay.
5. Adding varroa mite-specific challenge cards to the game.

Further, minor recommendations can be incorporated to enhance *Tiaki*. Adding an instruction to tell players which individual should begin the game may improve delays at the game's start. Adding a Māori terminology glossary into the rulebook can enhance educational context. Labeling "Strategy 1" and "Strategy 2" on scenario cards could limit confusion to which "method strategies" they are deciding between as stated in the rulebook. Clearly explaining the overarching goal of the game in the rulebook, changing the phrasing to identify how the game is won or lost. Finally, adding post-game discussion questions at the end of the rulebook for players to reflect on what they learned after gameplay will allow for group reflection and further

content retention.

To further enhance *Tiaki*'s impact, we suggest conducting playtests with local educators and targeting younger generations for future studies. This would ensure the game's educational effectiveness and expand its reach in classrooms, fostering greater awareness of pest control.

Conclusion

Tiaki marks a significant step in using serious gaming for pest management education in New Zealand. By transforming learning into an interactive experience, the game helps players better understand the challenges faced by native species and build confidence in players' roles in conservation. Moving forward, continued refinement of *Tiaki*'s mechanics and educational impact will ensure it grows to a finalized tool for fostering awareness and collaboration to promote Aotearoa's pest management efforts.

EXECUTIVE SUMMARY REFERENCES

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ACKNOWLEDGEMENTS

ABOUT THE ARTIST

Amber Strain

"I'm a 29-year-old Creative based in Tāmaki Makaurau, specializing in making narrative-driven immersive experiences. I offer a variety of creative solutions not limited to Spatial Design, Motion Design, Architectural Rendering & Flythroughs, Illustration, Painting, Graphic Design, Virtual Reality, Projection Mapping, and Interactive Digital Experiences. As a jack of many trades in the creative field I love any project that blurs the lines between art and design or the virtual and physical." - Amber Strain, 2025

# MEET THE TEAM

Abigail Rivers

Hello! I am a junior at Worcester Polytechnic Institute studying Biomedical Engineering. On campus, I am the president of Biomedical Engineering Society and a front desk-assistant at the Housing and Residential Experience Center. This project allowed me to gain perspective on how other cultures view the Earth and the nature that resides on it.

Catherine Sauter

Hi! I am a junior at Worcester Polytechnic Institute studying Biomedical Engineering. On campus, I am a part of the Society of Women Engineers and am a front-desk assistant at the Housing and Residential Experience Center. This experience gave me a new outlook into the importance of environmental protection to preserve native culture and values.

Emma St Clair
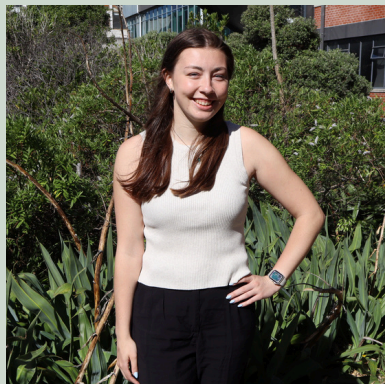
Hi! I am a junior at Worcester Polytechnic Institute studying Mechanical Engineering. On campus, I am the Assistant Director of Engineering Ambassadors and a part of the Society of Women Engineers. This project gave me insight into a different culture and allowed me to gain a new perspective on pest control methods.

Diego Winsor

Hey! I am a junior at Worcester Polytechnic Institute studying Architectural Engineering. On campus, I am the vice president of Architectural Engineering Institute. Throughout this project, I enjoyed immersing myself in a new culture, talking with locals about their passion for environmentalism, and learning about mātauranga Māori.

AUTHORSHIP

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The Team Behind *Tiaki*	C. Sauter	A. Rivers, D. Winsor
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Assess the impact of *Tiaki* on participants	C. Sauter	E. St Clair, D. Winsor
Moving forward and recommendations	D. Winsor	A. Rivers, E. St Clair

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Evaluating how the design mechanics and components of *Tiaki* influence the user experience, playability, and engagement	A. Rivers	C. Sauter, E. St Clair
Measuring and assessing the impact of the *Tiaki* board game on participant knowledge	D. Winsor	A. Rivers, C. Sauter
Limitations	E. St Clair	A. Rivers, D. Winsor
Discussion	E. St Clair	A. Rivers, D. Winsor
Enhancing rulebook clarity	D. Winsor	A. Rivers, E. St Clair
Supplementing the awareness of Aotearoa's pests with a glossary	A. Rivers	C. Sauter, D. Winsor
Clarification of instructions in the rulebook to simplify card ambiguity	C. Sauter	A. Rivers, E. St Clair
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Rule Book	The guidelines for the aim, set-up, and gameplay of *Tiaki* are found here for players to follow.	

Component Name	Purpose	Image
Taonga Token	Tokens gained and placed on the board upon achievement of Method cards. The game is complete (won) with a gain of six taonga tokens.	TAKAHE
Pest Token	Tokens gained when Method cards are replaced throughout gameplay. The game is complete (lost) with a gain of six pest tokens.	FERRET

Component Name	Purpose	Image
Method Card	Strategy cards, distributed to players throughout gameplay used to respond to the Challenge and Scenario cards.	
Challenge Card	A card drawn in alignment with a Scenario card, posing a pest challenge that must be controlled throughout gameplay with Method cards. If no action is taken, players gain a pest token.	
Scenario Card	A card drawn to strengthen mauri. Upon achievement through Method cards, players gain taonga tokens.	

INTRODUCTION

The term tiaki is the Māori concept of caring and protecting for people, place, or culture, and is a core principle for many in Aotearoa New Zealand (About Tiaki, n.d.). Within its symbol (**see Figure 1**), each line represents a key element of New Zealand. Beginning from top to bottom, the four lines represent Ranginui (the sky father), Tane Mahuta (the forest), Papatuanuku (the earth mother), and Tangaroa (the ocean, rivers, and lakes). Overall, it serves as a reflection of the Māori values of guardianship, emphasizing the preservation of interconnected natural ecosystems and heritage.

The country lives with a legacy of shared impacts from colonization between Māori and the English Crown that have led to land disputes and ongoing struggles to honor principles outlined in the Treaty of Waitangi. This difficult historical and cultural context amplifies the unease and sometimes distrust that surrounds the use of pest control strategies to mitigate predator species on the fragile island nation. For many, particularly within Māori communities, pest management is seen as a direct disruption of tiaki, raising concerns about the long-term consequences to the culture's natural heritage.

Figure 1: Tiaki Symbol (About Tiaki, n.d.).

The ecosystem has a 1,000 year history with imbalance stemming from English and Polynesian colonizers and settlers who intentionally or unintentionally introduced pests that prey on local species, leading to population decline or extinction. Introduced insects, rodents, and larger mammals pose a significant threat to the fragile and isolated native species of Aotearoa. Conservation agencies in the country have therefore taken bold action to create awareness initiatives and to deploy methods eliminating non-native species (**see Figure 2**).

Figure 2: Conservation agency Pest Free Upper Hutt taking action using trapping.

The Biological Heritage research program has brought pest control campaigns to the forefront of public education and debate in support of Aotearoa New Zealand's native species. This program strives to protect biodiversity and biosecurity through aggressive pest control. A range of tools promote civil engagement and respectful dialog about complex decisions, and among them, serious games have excellent potential to enable players to explore real life scenarios facing scientists on the ground.

Tiaki is a serious game designed to be a new tool in pest control education. Dr. Ocean Mercier, Pat van Berkel, and other biodiversity experts in collaboration with the Biological Heritage research program developed the game. *Tiaki* targets New Zealand citizens, particularly those with a stake in pest control, to highlight different methods and their importance to the country's biodiversity. The goal of this project was therefore to evaluate the *Tiaki* game's effectiveness as an educational tool on the topic of pest control. To achieve this goal, we identified three objectives. The first objective was to understand the justification for using serious gaming for pest control education. Our second objective was to evaluate how the design mechanics and components of *Tiaki* influence the user experience, playability, and engagement. Our third objective measured and assessed the impact of the *Tiaki* board game on participant knowledge and interest.

From these methods, we obtained results on the game mechanics and educational ability it had. Some game mechanics, such as the rulebook and card information show room for enhancement and clarity. *Tiaki* presented an overall increase in pest management familiarity with its participants, as well as increased openness to seeing alternative perspectives from others on the topic. From our data collection and analysis, we designed recommendations to better prepare *Tiaki* for release and distribution into educational settings to be able to enhance pest control education and awareness.

This chapter outlines the background of introduced pest species and their threat to New Zealand's taonga (treasured) species. We introduce the work behind the current state of the board game *Tiaki* as well as its main collaborators and explore the value of using serious games in teaching about complex topics. Finally, we discuss the best practices to test and prototype serious board games.

Historical and ethical context of pest management in New Zealand

Human settlement brought extensive loss of native bird and lizard species in Aotearoa New Zealand. Colonists and settlers intentionally brought species for agricultural and recreational purposes (Russell, 2014). In addition to the intentional pests brought, travelers brought unwanted hitch-hiking species, resulting in over 90 introduced pests inhabiting New Zealand (Pimental, 2011). Some of these introduced pests include possums, rats, stoats, and other mustelids. Transplanted plants and animals continue to threaten native fauna, destroy habitats for bird species, and decimate hatchlings in their nests (Holdaway, 1989).

There are many pest control approaches under consideration to offset these predators in Aotearoa include trapping, the use of mātauranga (traditional Māori knowledge), poison, te ira tangata (the human element), and gene-tech (**See Table 1**). Trapping is an aggressive approach to population control, while Mātauranga focuses on decision-making while respecting Māori culture and beliefs. Some methods for mixing poison into baits aim to control predator numbers. Te ira tangata uses human engagement in pest management, often focusing on community driven efforts. Gene-tech is an emerging method, utilizing new technology like the use of gene editing to stop the reproductive capacity in pest groups. These different pest control methods each bring concerns regarding a balance of tool utilization and their intended or unintended consequences.

Gene Tech	Many gene tech uses, like Single sex offspring selection, can target specific pests, but is currently still in development.
Mātauranga	Using traditional Māori knowledge and cultural practices to manage pests while maintaining balance in the natural environment.
Poison	Using targeted, toxic bates to control pest populations, but can accumulate in environment and harm non-target species.
Te Ira Tangata	(the human element) Using community led efforts that encourage collective actions that target pests.
Trapping	using traps and lured placed in the pests habitat to target pests, but can be labor intensive.

Table 1: Definitions of terms in Historical and Ethical Context of Pest Management.

In addition, a combination of ecological, historical, and government-sparked factors deeply influences local views on pest control, specifically that of non-native species. Initiatives like Predator Free 2050 mobilize residents to engage in pest management methods as a citizen science project. Finding an ethical, widely supported method for pest management in Aotearoa is difficult, as there are conflicting attitudes towards different methods. However, the Department of Conservation's Dr. Edy MacDonald conducted a recent study surveying attitudes of New Zealanders about pests and their control, finding that 84% agree that "pest species are a significant conservation problem" and 61% "are aware of New Zealand's goal to become Predator Free by 2050 ("Public Perceptions of New Pest Control Methods", 2024). At the same time, Aotearoa holds a unique socio-political framework due to its history with the Treaty of Waitangi, an agreement between European settlers and Māori (Burns, 2024). This treaty created an expectation of respect between the two populations, mainly in protecting the pre-existing rights of the Māori. However, governmental policy has historically disregarded these rights and aspects of the treaty, highlighting the need for initiatives to restore them. This complicated and nuanced perspective emphasizes the need for a framework that keeps the Māori community in conversations that affect Aotearoa's biosystem, reflective of their historically rooted values (Clark, 2023).

In sum, efforts to encourage the public to accept the advancement of pest control methods include proper education, public engagement, and ethical protocols in gene-editing techniques. In the absence of

evidence-based engagement, public support for informed technological decisions will remain a barrier in pest control initiatives. Achieving this support begins with new tools and strategies in educating the public through civil, productive discussions.

The team behind *Tiaki*

Tiaki's mission bonds the team that has contributed to the game's goals, development, and educational impact. These individuals and groups created a space for players to promote a shared understanding of the implications of pest control methods. Game partners, Dr. Ocean Mercier, a Professor at Victoria University of Wellington, and Pat van Berkel of Pest Free Upper Hutt collaborated with others in the Te Kawa a Māui (School of Māori Studies) to serve as the designers for the *Tiaki* game, along with graduate student Tere Porter-Rawiri. Dr. Mercier's research on biotechnology and pest control methods in New Zealand, especially in the context of Māori co-governance, informed many of the game's learning outcomes. Her contributions to the project were essential in maintaining the game's educational value while also working with game developers to make it engaging and accessible to local communities. She and Pat van Berkel collaborated with the Biological Heritage Research Program, a New Zealand-based initiative focused on education for environmental

preservation, stressing alignment between scientific research and public engagement (**see Figure 3**) ("Public Perceptions of New Pest Control Methods", 2024). Through the *Tiaki* game, scientific and ethical considerations can become more accessible to the general public and conceivably increase awareness in communities on pest control methods and emerging solutions. Third Studio, a design firm in Wellington co-run by Ellie Tuckey and Mitra Homolja, developed the board game to be collaborative. It is meant to encourage teamwork and thoughtful dialogue using prompts, and to create interactions between players that could catalyze reevaluation or redefined values.

Figure 3: The Biological Research Heritage Program logo ("Public Perceptions of New Pest Control Methods", 2024).

The game has implications for educators who serve as significant stakeholders in *Tiaki*'s success. Individuals with an informed view of environmental issues and solutions are targeted players of the game, however members of the public can participate as well. The goal is for participants to widen their knowledge, to contribute to broader dialogue, and to have an open mind towards differing views on the

topic. The outcomes could be significant as participants may develop a confident voice in future policy decision-making from their experience with *Tiaki*.

Tiaki game rules and objectives

Tiaki invites players to work together to strengthen the mauri (life force) of Aotearoa by protecting the balance of taonga (treasures) and managing pests. The game presents real-life scenarios, with each player receiving method cards to help address the challenges. When players complete the scenarios, they receive taonga tokens, which strengthen the mauri; however, if the players do not control the challenges, they place a pest token on the board. The game ends when the players win as a team and receive six taonga tokens or lose when they receive six pest tokens.

Method cards display different forms of pest control and players use them to complete scenarios and challenges. Pest control method cards include trapping, mātauranga, poison, te ira tangata, and gene-tech. Scenario and challenge cards provide different pest-related problems that players must solve using their method cards. **Figure 4** provides a set-up of the game and the cards. Refer to the **Game Glossary** for game components and **see Appendix A** for rulebook.

Figure 4: The layout of Tiaki during gameplay.

Testing game processes and outcomes: best practices

Unlike traditional educational tools, serious board games such as *Tiaki* engage players in dynamic, hands-on learning experiences that foster critical thinking, teamwork, and problem-solving. Serious board games are set apart by their ability to make learning fun, immersive, and reflective of real-world challenges. These games not only encourage

strategic thinking but also promote discussions about complex issues in a light-hearted, low-pressure environment. (Young, 2012). To effectively use board games for educational purposes, educators must thoughtfully implement them in public spaces, such as classrooms or other learning environments so that participants can commit to the process. When designing a serious game, it is essential to consider how the game mechanics will immerse players while simultaneously reinforcing the intended learning outcomes. Furthermore, the best experience requires presenting these games "in concert with good teaching" (Young, 2012).

Pilot testing can use a blend of evaluation methods to ensure game quality and intended outcomes before deploying them to the public. One of the first evaluation steps is participant observation, a qualitative research methodology where the research group participates in their experiment to experience the game informally and identify unanticipated challenges. This allows the group to understand participant behavior, fostering a greater connection between the researcher and future participants. Playtesting, where developers trial the game with their target audience to evaluate its effectiveness, engagement, and capacity for teaching, is a crucial step in serious game evaluation ("Participant Observation", 2019). Watching how players interact with the game is key to adjusting the content to fit the specific needs and culture of the target audience. Additionally, assessing the game for usability and engagement can improve clarity and minimize frustration with respect to the interface and mechanics. Using non-disruptive game tracking in playtesting sessions can help gather insight on the players' genuine behavior rather than behavior influenced by external interruptions. This can yield scenarios that reflect realistic playing experience (Serrano-Laguna et al., 2018).

Learning from ExpandED and simulation-based games

We explored the value and potential pitfalls of serious games in a case study that evaluated ExpandED - an expansion of the serious board game GridlockED created at McMaster University. This game, aimed at college medical students, reflects the modern-day emergency department (ED) by simulating the pressure of working and managing an ED shift with a variety of medical professionals (social workers, nurse practitioners, and occupational therapists). Patient cards and event cards force the players to consider multiple points of view when making decisions about patient and caregiver management (Fiala, 2024).

To test the effectiveness and educational value of the game, the research team, including a group of both medical students and faculty, used a mixed-methods

approach to conduct an evaluation with 45 participants in small groups from various health and medical programs at McMaster University. The team utilized pre- and post-game surveys to map changes in viewpoint regarding ED workflow, perceptions of roles in healthcare, and the value of interprofessional collaboration. The pre- and post-game surveys collected information about the players prior exposure and game's playability, player's enjoyment, and educational effectiveness through a series of seven-point Likert scale (1=not familiar and 7=extremely familiar) (**see Figure 5**), yes/maybe/no questions, and open responses.
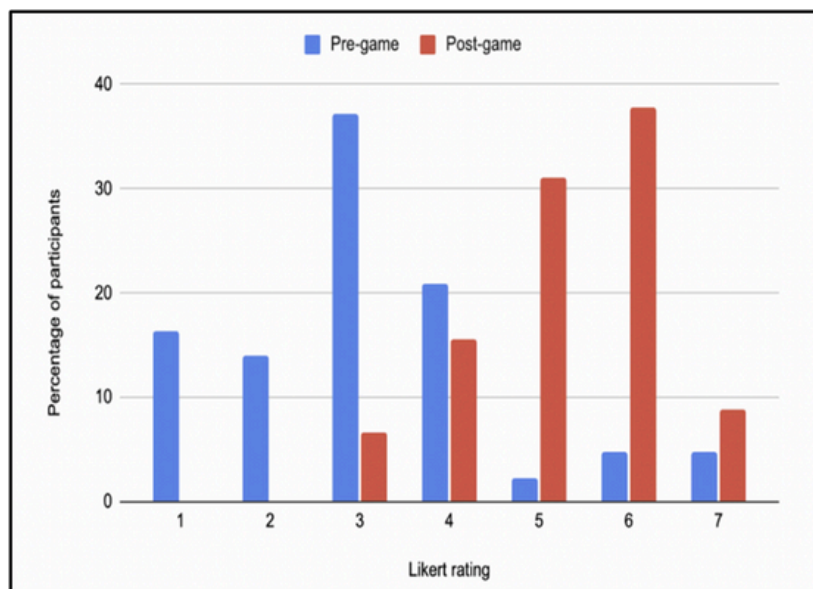
Figure 5: Graph displaying survey results of pre- and post-game understanding of emergency department workflow on a Likert scale 1-7 (1=not familiar and 7=extremely familiar) (Fiala, 2024).

The study found a possible "ceiling effect" when it came to the players' views on interprofessional collaboration, as there was only an average increase in understanding from 6.2 (pre-game survey) to 6.4 (post-game survey) on the Likert scale survey. In this context, the ceiling effect refers to the phenomenon where the participants' initial attitude towards a concept is already at such a high level that new experiences will not significantly increase outlooks in a post-game survey. This suggests that while ExpandED may have reinforced players' positive views, it could not further elevate them. This study reinforces the importance of simulation-based learning, specifically in the field of medicine, as a tool for equipping students with experience prior to entering a professional field. By using a mixed-methods approach for evaluation, the researchers uncovered measurable changes in knowledge and player satisfaction.

Serious games, such as ExpandED, stem from the process of engaging with complex scenarios that challenge participants to critically evaluate their current knowledge and beliefs. This simulated decision-making enables players to gain an informed perspective and assists them in expressing their positions in an effective manner. Furthermore, serious games encourage development of a shared agenda for action. Fostering collaborative dialogue between participants encourages them to prioritize collective goals. This type of outcome can directly apply

to pest control strategies. This enables a diverse range of stakeholders to align with the most effective method for addressing issues within the content of serious games, a goal the creators of *Tiaki* considered when designing its mechanics.

Summary

Serious games can be an effective tool to inspire a community conversation or action about pest control. Understanding, adapting, and catering to the complex viewpoints of the stakeholders is important in creating a product that is accessible and educational. Those with differing opinions can work together to simulate strengthening the mauri of their environment through thought provoking pest management efforts. By engaging the community in learning efforts of Tiaki, players can participate in discussions about emergent technologies, connecting them through shared knowledge gained from playing the game.

We researched best practices in testing serious games to discover possible challenges, including ensuring that playtesting sessions are conducted in an environment with minimal disruptions during sessions that will influence players' behavior and reactions. Further, we learned of the importance of tracking in the same non-disrupted manner to record genuine feedback and engagement levels. The ExpandED case study introduced testing methods of pre- and post- game surveys that include Likert Scale and open response questioning for a well-rounded approach to data collection from playtesting sessions of serious games.

Our primary goal was to evaluate the *Tiaki* game's effectiveness as an educational tool on the topic of pest control in New Zealand. To achieve this goal, we identified three objectives:

1. Understand the justification for using serious gaming for pest control education.

2. Evaluate how the design mechanics and components of *Tiaki* influence the user experience, playability, and engagement.

3. Measure and assess the impact of the *Tiaki* board game on participant knowledge and interest.

We designed the objectives to generate results that we analyzed to be able to create a set of recommendations to prepare the *Tiaki* game for release and distribution into educational settings, as summarized in **Figure 6**. The following sections discuss the strategies that we implemented in detail.
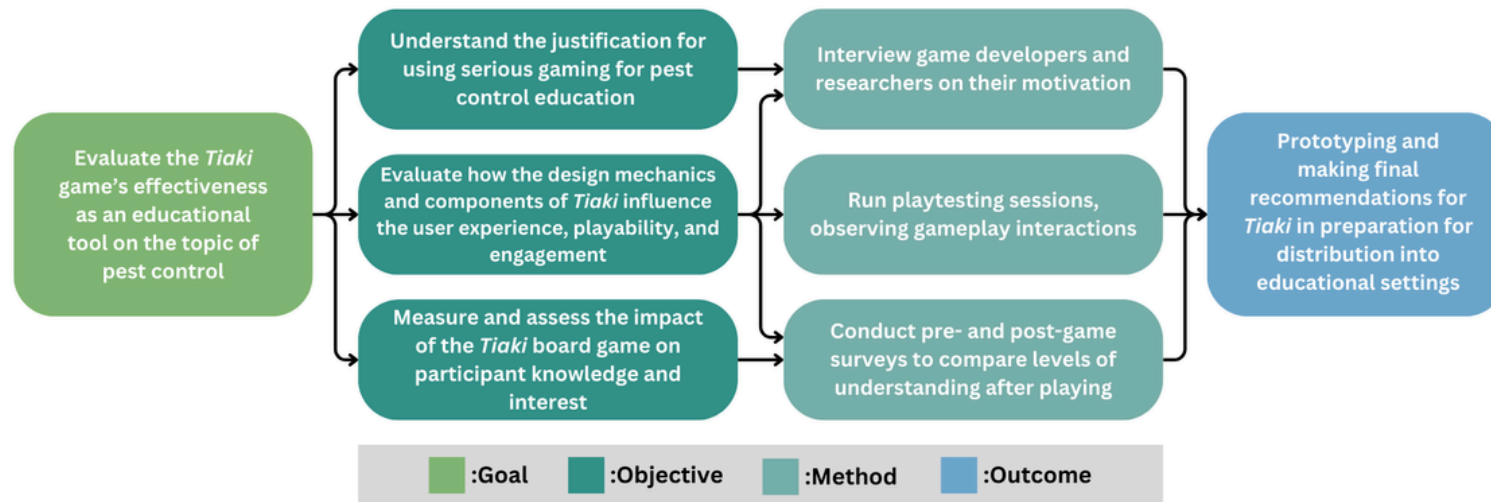
Figure 6: A flowchart displaying the project's goal, objectives, and intended corresponding actions

Objective 1. Understand the justification for education through serious gaming

To understand the development process and design motivations behind *Tiaki*, we conducted semi-structured interviews with members of the team that brought the project to fruition. We met with graduate student Tere Porter-Rawiri from Victoria University of Wellington. Porter-Rawiri is a leading game designer who worked with Dr. Mercier on developing *Tiaki*'s content. We focused this discussion on teaching-related goals with the inclusion of pest control concepts in an interactive manner.

In addition, we interviewed a member of Third Studio: Ellie Tuckey, who was one of the game developers responsible for the visual design and collaborative format to grasp aesthetic decisions, gameplay mechanics, and how these choices supported the game's purpose. We designed these interviews to give insight into the purpose and path of creating *Tiaki*, an important factor that helped us determine how to conduct playtesting sessions. An interview guide for these semi-structured interviews can be found in **Appendix B**.

Objective 2. Evaluate how *Tiaki*'s design mechanics influence user experience

We explored the influence of *Tiaki*'s design mechanics and components on user experience through participant observation and early playtesting. Our participant observation session first included our group setting up the game, reading the rules, and taking initial notes about our expectations. We then played the game, making sure to individually note any points of confusion or interest. After playing, we reflected on our game experience, recording our thoughts and main takeaways.

To develop our playtesting protocol, we sent a participant outreach email to potential players including students, conservation advocates, and other individuals that may be interested in pest control (**see Appendix C**). Our project partners shared a spreadsheet with contacts in conservation and related academic fields that we used as a baseline for snowball sampling to encourage participation in the test sessions. After a participant replied with interest, we sent a follow-up email (**see Appendix D**) with a form (**See Appendix E**) that outlined specific playtesting session times. We also posted flyers (**See Figure 7**) around Victoria University and board game stores around Wellington that directed interested players to the availability form. After

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creating groups based on their responded availability, we sent a final email (**see Appendix F**) confirming their team playtesting session time and date.

Figure 7: Playtest outreach flyer

Before playing, each participant completed a consent form outlining how the session will run and how the team will use recordings for research purposes only (**see Appendix G**). Our observations during gameplay documented user interactions, decision-making processes, and collaborative engagement levels.

Our team held playtesting sessions in a conference room at the Ngā Mokopuna building at Victoria University of Wellington (**see Figure 8**). During these sessions, one member of our team served as a host, leading the opening words, administering pre- and post-game surveys, and stopping the game if it exceeded the 90-minute time limit. Within the opening words, the host emphasizes the game's collaborative nature as explained in each section of the rulebook (**see Appendix A**). Then, just before beginning the game, the host prompted participants to read the rulebooks on their own without explanation from the host. However, the host asked participants to read each card out loud during gameplay to ensure all players heard their content (**see Appendix H** for our host script). A second teammate designated as scribe recorded notes on a pre-written observation worksheet throughout gameplay to identify areas for improvement (**see Appendix I**), as well as key moments of discussion or player interaction with their timestamp. To supplement the notes taken, a camera set up on the conference room table and an audio recording

device placed next to the game board took audio/visual recordings of the players' hands, table, board, and cards (see **Appendix J**).

Figure 8: Playtesting room setup and sample gameplay frame

Tiaki recommends player group sizes of two to five players. Throughout playtesting sessions, we made sure to have at least one group of each size (two, three, four, and five players) to compare engagement levels in the post-game survey analysis (**see Table 2**).

Number of Players	Two	Three	Four	Five
How many sessions occurred	3	3	3	1

Table 2: Playtesting group sizes and amounts

Objective 3. Assess the impact of *Tiaki* on participants

With the purpose of assessing the impact of the *Tiaki* game on participants, we evaluated if and/or how each players' knowledge and understanding of pest control methods changed throughout a play session. Playtesting participants filled out a pre- and post-game survey (**see Appendix K & L**) to gauge their levels of understanding and comfort surrounding pest control methods in New Zealand and how these levels may have been changed from game play. These surveys utilized Likert scale questions, a surveying tool that measured attitudes, perceptions, and opinions on a linear, five-level scale. Pre- and post-game assessment prompts included questions about views on pest control (**Q.K1-Q.K2, Q.L1-Q.L3**) and game characteristics (**Q.L4-Q.L11**): critical points in determining whether the game achieved its aim of educating while being entertaining (Gris, 2021). To compare Likert scale responses of individual players, we asked participants to write their names on each survey completed. With a sample size of 32 participants, we performed a statistical t-test to find statistically significant changes in knowledge level towards pest control (Joshi, 2015).

In addition to Likert scale data, we included open ended response questions in the pre- and post- game surveys to gather qualitative data to assess. We organized these responses in an Excel spreadsheet into categories such as essential understanding of pest control methods, perceptions of the game's educational value, and suggestions for improvement. To assess trends, we coded for thematic patterns and relationships within these categories. We reviewed these responses to provide supporting insights and context for our quantitative findings. At the end of the post-game survey, we include an optional question asking for the participants' contact information to inform them on future *Tiaki* related studies and presentations. At the end of the post-game survey, we include an optional question asking for the participants' contact information to inform them on future *Tiaki* related studies and presentations.

To progress to analyze final recommendations, our team analyzed trends in qualitative and quantitative data, gathering information on points of confusion and issues with gameplay, as well as noting aspects that were especially successful in the game design. We organized and ranked recommendations for a review session with our partners to discuss appropriate revisions to the game content and process.

This chapter presents our results on the overall effectiveness of the board game, *Tiaki*. We organized these results by objective.

Understanding the justification for using serious gaming for pest control education

Tiaki developer and designer interviews

From our conversations with *Tiaki*'s designer, Tere Porter-Rawiri, and developer, Ellie Tuckey of Third Studio, we uncovered essential themes that shaped the creation of the board game. These themes, related to the justification behind using gaming for education, helped us understand why Porter-Rawiri and collaborators chose a collaborative, serious game over other educational methods. These interviews provided insight into the process behind creating *Tiaki*, including its open-ended format, prime demographic, and how graphics aid in engagement.

Tere Porter-Rawiri provided valuable knowledge into the construction of *Tiaki*'s content. For Porter-Rawiri, studying genetic modification is the bridge that connects her passion to pest control efforts (**see Figure 9**). This personal motivation inspired her involvement in *Tiaki*, where she aims to encourage player engagement and information retention of pest control technologies that have emerged in the last decade. Within the game content, the responsibility of the player was an important factor in the creation of the method cards. Porter-Rawiri believes a two-way exchange of information is more effective in fostering a sense of community and learning through discussion rather than a traditional educational format.

> "We wanted it to be **open-ended** because that's the reality of it. Like **no** one has put **rules** on [gene tech] yet." - Tere (Jan, 23,2025)

Figure 9: Quote from Tere's interview

She wanted players to discuss the contexts of their actions, emulating discussions between experts and policymakers who make decisions that affect pest control efforts. Porter-Rawiri helped design *Tiaki* to appeal to three key demographics: the casual tabletop gamer, the New Zealand resident interested in pest control efforts, and the academic who could apply *Tiaki* in a classroom setting. Porter-Rawiri views success as players absorbing any information, no matter how small, recognizing that

complete opinion shifts on such a complex topic over the span of the *Tiaki* game are unrealistic.

Tuckey, co-director of Third Studio, provided insight concerning Third Studio's mission: incorporating collaborative processes into their products to promote meaningful discussions. She stated that an engaging story served as a foundation of *Tiaki* that fostered player immersion, making collaboration a natural outcome of gameplay. To fuel this narrative and motivate game play, Third Studio added the game board and tokens (**see Figure 10**) in addition to playing cards, creating an interactive storytelling experience and tangible end goal. Native species act as the story's protagonist while the invasive pests take on the antagonist role, with color theory playing a key role in token design. The taonga tokens are blue, a color often associated with positive connotations, encouraging the players' positive connection with the visual characteristics as they progress to a winning outcome. Pest tokens, on the other hand, provide sustained motivation through their orange color and association to the challenge posed by invasive species.

Figure 10: Taonga and pest tokens

Tuckey worked with graphic designer Amber Strain to design the vibrant, attention-grabbing imagery on each card to enhance interest and connection to each method, weaving storytelling elements into the written text. To support Third Studio's vision, Tuckey states that both visual and written content needs to blend to create an engaging, educational, and artistic gaming experience. Tuckey's idea of success is creating a safe space to have fun, learn, and to be able to debate pest control methods without the stigma surrounding contentious topics.

Evaluating how the design mechanics and components of *Tiaki* influence the user experience, playability, and engagement

Tiaki developer and designer interviews

In the semi-structured interview with Third Studio, Ellie Tuckey emphasized the crucial timing of a game: if it is too long, players lose interest but if it is too short, they do not absorb the necessary information. While discussing game content, designer Tere Porter-Rawiri noted that *Tiaki* cards represent real stories and actual methods of pest control in New Zealand, thereby connecting the player to a specific event rather than hypotheticals. Initially, Porter-Rawiri and her team considered a more complex board game

format, but they chose a more simplistic form of the game for ease of play. This allows players to focus more on the educational information and story that *Tiaki* is telling.

Participant observation

When first receiving a physical copy of *Tiaki*, our team conducted our own participant observation to grasp the rules, structure, and overall experience while playing the game. Without prior knowledge of the game mechanics, and starting the session with limited context, we recorded our opinions attempting to avoid bias in the process. Following a delayed initial understanding, our experience in the game was productive with an occasional obstruction when there was disagreement over the ambiguity of certain cards. This initial playtesting gave us a brief insight into how players could react when faced with similar challenges. It is also important to note that the case and context for genetic modification for pest control in New Zealand was new to us in the U.S.

Playtest session observations

During playtest sessions, the scribe's notes highlighted the causes of common delays during the first few turns including confusion with the rules and the organization of card placement. In addition, the host often observed player uncertainty in the distinction between scenario and challenge cards which the host had to clarify to ensure the game would progress properly. Players were unaware that they could only respond to scenario cards on their turn, while any player could respond to challenge cards, no matter the turn order. Once the players gained a taonga or pest token, their understanding of the game grew, and players began to shift to a strategic mindset during gameplay where they were more open to sharing their cards content and how each would best achieve their goal of achieving more taonga tokens.

The ambiguity of the challenge cards periodically sparked mixed reactions throughout the session. Players found these cards to be quite open ended and some participants were unsure if they could place the method cards in their hand to complete the challenge cards. Conversely, this left room for player discussion about which method cards would be most effective for the given scenario. This collective decision-making process enabled players to share different perspectives and strategize together. The host observed the leftover cards in players' hands after the game had concluded. They found that most players had method cards targeting Varroa mites that they never used. Multiple players noticed this, as they never came across a challenge card that called for the removal of the Varroa mites, showing their absence throughout gameplay. In counting the

number of cards in which Varroa mites are included, we found that eight method cards had information about the mites, while no challenge cards mentioned them.

Even with the delays in play due to the previously outlined common player confusions, each playtesting session had moments when the players were actively engaged with the game and its contents. The host observed that in every session, players would engage in conversation, sharing stories and laughter towards cards they connected with personally. Players' responses to challenge cards that were ambiguous produced the greatest moments of interaction and engagement, with the table coming up with ideas about how they could connect their method cards to the current pest issue (**see Figure 11**). The physical board and card artwork also gained a lot of attention, with players immediately commenting on how well designed and aesthetically pleasing it is.

"The rules for when and if you could play certain cards in response to **challenges and scenarios** was **unclear**, but... that also lends itself to some fun and **interesting conversations** determining if we would play thematically or loosely."

Figure 11: Player survey quote

Survey results

Figure 12 indicated player responses in the post-game survey question 6: 'Rate the ease of gameplay.' Most responses fell between 'somewhat difficult' and 'somewhat easy.' There was only one player that believed *Tiaki* was very difficult to play.
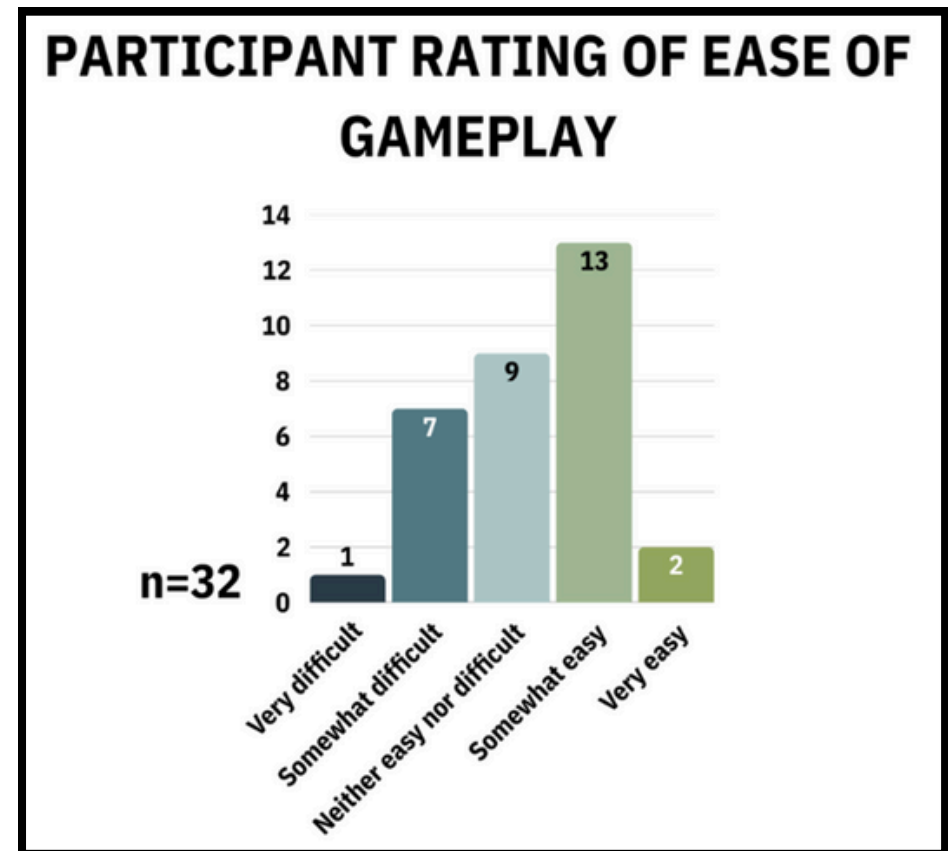
Figure 12: Survey results showing participants' ratings of the ease of gameplay: n= 32

Participants also rated the written characteristics within the game cards in the post-game survey question 5 as seen in **Figure 13**. This question asked the players to 'Rate the written descriptions of the game," with 75% of players ranking them 'quite interesting' or 'very interesting.'

Our findings revealed 15 out of 32 players noting a specific moment of confusion or part of the game they felt was not clear. From coding responses that mentioned areas of improvement, three themes came to light: card ambiguity, background context, and rule clarity. **Table 3** shows that card ambiguity and rule clarity were the most recurring themes that participants mentioned for areas of improvement.
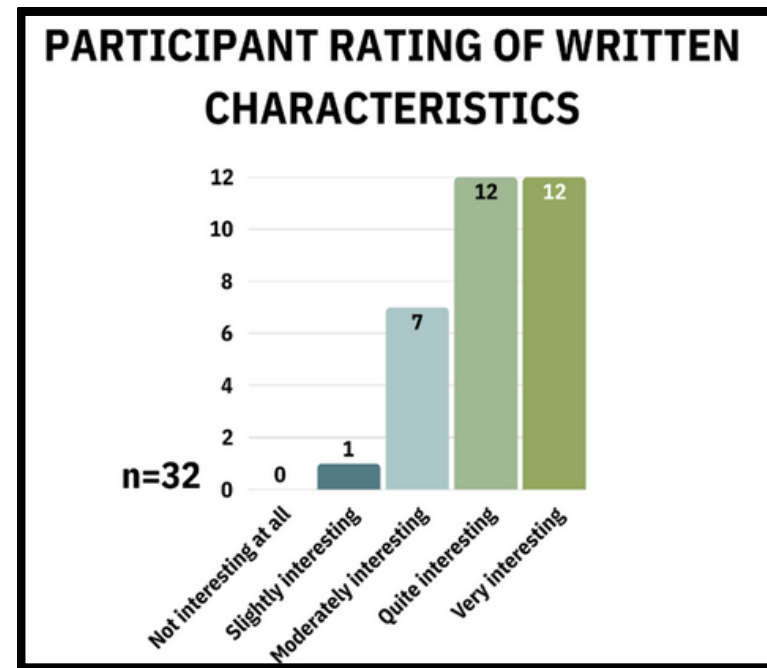
Figure 13: Survey results showing participants' ratings of the written characteristics: n= 32

Category	Player 6	Player 7	Player 8	Player 13	Player 14	Player 15	Player 16	Player 18	Player 20	Player 21	Player 22	Player 25	Player 30	Player 31	Player 32	Total
Card Ambiguity	X	X	X		X			X	X	X	X		X	X	X	11
Background Context					X				X					X		3
Rule Clarity	X			X	X	X	X					X	X	X		8

Table 3: Coding table of areas displaying the count specific game improvement discussed in the post-game survey: n= 3

Measuring and assessing the impact of the *Tiaki* board game on participant knowledge

Survey results

Figure 14 illustrates player response to question 1 in both the pre- and post-game surveys. Using the Likert scale, question 1 asked "How familiar are you with pest control methods in Aotearoa New Zealand?" The goal was to use player responses to assess the game's impact. Of the players that participated, 53% had an increase in familiarity after playing *Tiaki* with an average point increase of 0.86.

We used a two-tailed, paired t-test to evaluate the statistical significance of this difference. We used a 95% confidence interval, comparing individual responses of familiarity level in the pre-game survey (group one) against the responses in the post-game survey (group 2). The standard error of difference (0.152) and the t-value (5.351) for this calculation resulted in a two-tailed p-value of <0.0001. Therefore, the difference in levels of familiarity of pest control methods before and after playing *Tiaki* are statistically significant.
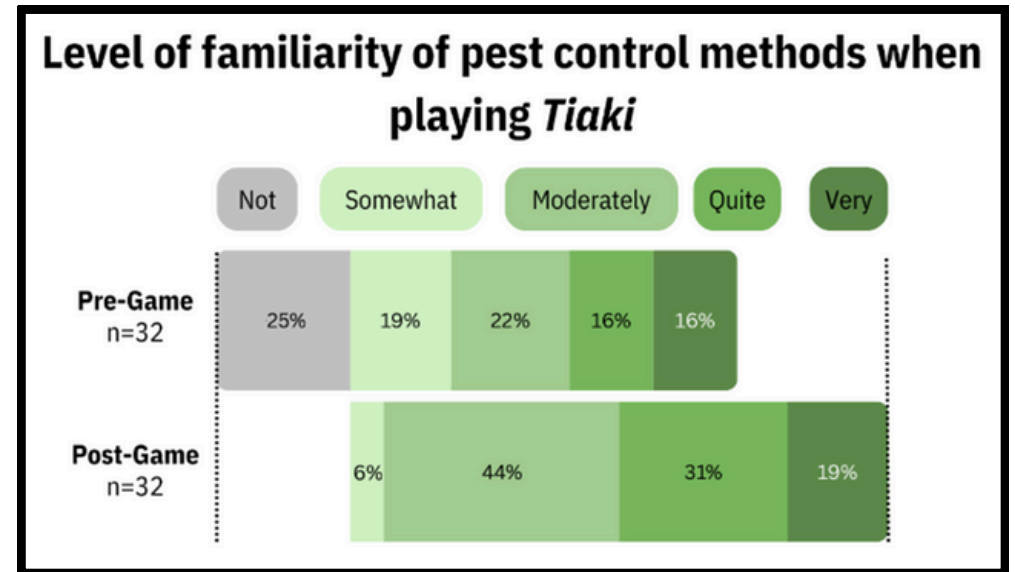
Figure 14: Graph displaying survey results of pre- and post-game familiarity of pest control methods in New Zealand on a Likert scale from 1-5. n= 32

We used open response style questions in the post-game surveys to gather important information about the impact on players after they played *Tiaki*. Key questions involved if the player's views or knowledge changed after playing *Tiaki* and explaining why or how the game induced these changes. After coding for themes within players' responses, we found three main themes being gene-tech ethics, seeing alternative perspectives/methods, and poison ethics. The most recurring theme was players mentioning that playing *Tiaki* made them think about and understand how people may have different perspectives regarding pest control, with 9 out of 32 players mentioning this topic (**Table 4**).

Category	Player 3	Player 5	Player 8	Player 9	Player 10	Player 11	Player 12	Player 13	Player 17	Player 18	Player 27	Total
Gene Tech Ethics	X		X							X		3
Seeing Alternative Perspectives/Methods		X	X	X	X	X	X	X	X		X	9
Poison Ethics			X			X	X					3

Table 4: Coding table displaying count of topics mentioned in open response question regarding challenged or changed views on pest control: n= 32

These players stated that the playtesting session had given them a new perspective about pest control through the discussions and cards throughout the game (**see Figure 15**). One player specifically mentioned how it put them in a decision-making position whereas before playing *Tiaki*, they had only thought about it in a theoretical way. In addition to alternative perspectives mentioned ethics about gene-tech and three about poison ethics. Most of the players that mentioned poison spoke about how it is not ethical and shouldn't be the primary form of pest control. For those that had mentioned gene-tech and ethics, some of them grew more open to using gene-tech for pest control, although others became more concerned with the idea pest control initiatives implementing it.

We investigated the impact of player size on the engagement level of discussions held during *Tiaki*. Using the Likert Scale, question 7 of the post-game survey asked:

> "I enjoyed thinking about the subject matter and **reflecting** on my playmates **different perspectives**... my playmates were significantly more averse to poisons and that did **give me pause**."

Figure 15: Additional player survey quote

"How engaging were the player discussions held during the game?" We compared these responses against the number of players in each session, taking the average of the engagement level response for each playtesting session size: 2, 3, 4, and 5 participants. Overall, we found a slight decrease in player engagement with discussions held during gameplay compared with session size, with a playtesting size of 2 participants having an average engagement level of 4.5 and a playtesting size of 5 participants having an average engagement level of 4 (**see Figure 16**).

PARTICIPANT ENGAGEMENT IN DISCUSSION
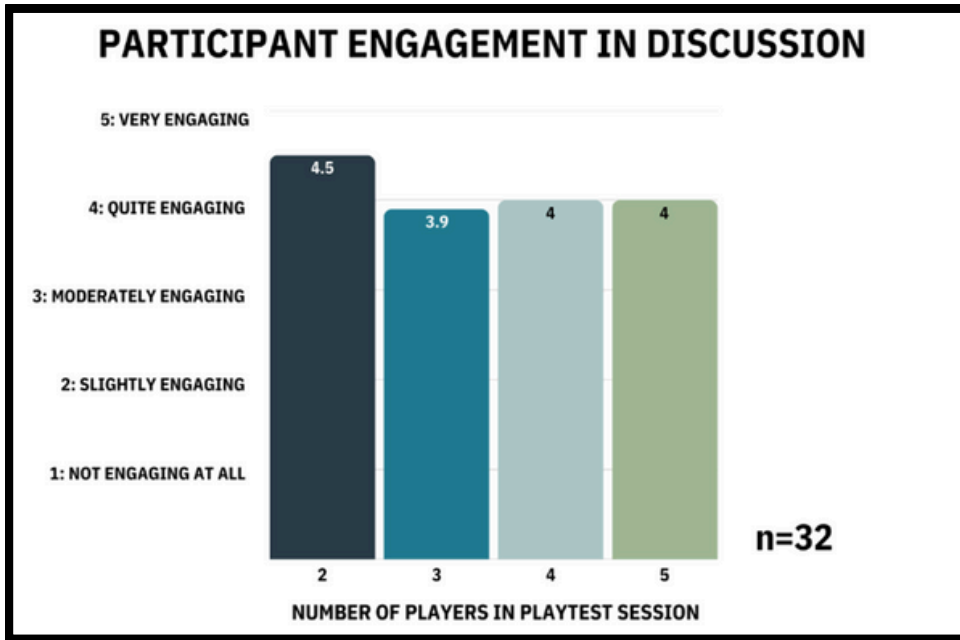
Figure 16: Chart comparing average Likert scale rating of player engagement in discussion to the number of players in the corresponding players' group size: n=32

Limitations

One of the important limitations of our research was the composition of our testing demographic. Since we recruited the majority of participants from the Victoria University Māori Studies school and pest control fields, many had prior knowledge of Māori culture and various pest control methods, creating a ceiling for the amount of information learned. Ten players initially ranked themselves in the two highest levels of familiarity and only one of those players had an increase in familiarity. Those who already have a

strong grasp of the pest control concepts taught in the game will not learn as much as those who are just learning about pest control methods. From a locational perspective, due to time and travel budget constraints, we confined our testing to the Greater Wellington Region, which limits the applicability of our findings to other areas with different demographic or cultural characteristics. Furthermore, the Worcester Polytechnic Institute's Institutional Review Board restricted our study to individuals aged 18 and older, excluding younger populations. The younger generation is one of Tiaki's developers' key demographics, with the goal of implementing Tiaki in schools for college and university students to learn the basics of pest control techniques and decision making.

Discussion

The interviews with designer Tere Porter-Rawiri and developer Ellie Tuckey highlighted the importance of balancing engagement with education. Tere's approach to incorporating real and current pest control methods and her emphasis on discussion-driven learning reinforced the idea that interactive learning can be more effective than traditional methods. Tuckey's contributions in game development further supported this concept by ensuring the combination of visual and narrative components in Tiaki create an engaging experience for players.

Analyzing *Tiaki*'s design, gameplay mechanics, and player engagement gave us valuable insights into the effectiveness of using a serious board game for educational purposes. Through participant observation, we identified how players may responded to moments of confusion and intrigue, allowing us to track key themes throughout gameplay sessions. However, our results highlight specific areas such as rule clarity and card ambiguity that affected the ease of gameplay and led players to seek additional guidance during playtesting. Additionally, the limited presence of Varroa mite cards reduced their impact, as players were unable to connect them to challenge cards in meaningful ways.

Playtesting observations showed that while players initially struggled with some gameplay aspects, such as distinguishing between scenario and challenge cards, their engagement increased as they became more comfortable and familiar with *Tiaki*'s mechanics. This suggests that despite a learning curve, *Tiaki* enables players to have in-depth discussion and increased critical thinking surrounding conversations about pest control through collaboration. The survey results before and after the game confirmed its positive educational impact, with most players reporting an increased familiarity with pest control methods. The shift to the right in **Figure 14** of the post-game graph further indicates that players' knowledge improved after engaging with *Tiaki*.

In assessing *Tiaki*'s impact, open-response survey themes including gene-tech ethics, alternative perspectives, and poison ethics demonstrated that the game encouraged players to consider complexities and ethical dimensions of pest management. This aligns with Tuckey's goal of fostering nuanced discussions instead of enforcing a singular viewpoint. Many participants expressed that playing *Tiaki* encouraged them to consider perspectives they had not previously thought about surrounding pest control methods, showing a broadening of awareness with the topic. Additionally, players found the written content on the cards informative, as evidenced in **Figure 13**, highlighting the role of well-crafted writing in enhancing the learning experience.

Regarding playtesting size, our sample showed a slight overall decline in engagement as the number of players increased with individual responses reporting a lower engagement from larger playtest sessions. This does not directly indicate a negative effect, as larger groups may have led to more passive participation from certain individuals. Despite this, overall engagement levels remained high, demonstrating how players were actively involved in discussion and deeply engaged with conversations sparked by the game.

Tiaki's playtesting sessions revealed areas for refinement. While minor design adjustments will benefit the game's objectives, our findings affirm that the overall reception of *Tiaki* was positive, providing insight to its impact on player engagement and learning outcomes.

Our results and analysis provided us with some elements of the *Tiaki* game that we can enhance for a greater educational and more enjoyable playing experience. By interpreting player feedback and analyzing playtesting data, we also identified key aspects of *Tiaki* that are essential for players to retain its core themes. Specifically, we focused on its collaborative nature and focus on pest management. Our recommendations are tailored towards increasing the educational value *Tiaki* holds.

General recommendations

The primary recommendations from our project to improve the *Tiaki* board game are listed below. In addition, we included a table of additional suggestions that are less crucial for game success but can contribute to game satisfaction.

Recommendation 1
Enhance rulebook Clarity

Justification

Tiaki's game rules use few, simple components, but the cards' varying meanings may be unclear when a player first draws a method, challenge, or scenario card. During playtesting observations, we found that gameplay halted during the first round of turns due to questions surrounding the sequence of actions in a turn and the distinction between scenario and challenge cards.

Action

To improve comprehension of these items, we recommend incorporating more gameplay images into the rulebook. Providing pictures of card placement, action sequence, and the requirement to complete a scenario before obtaining a challenge would offer valuable reference points. These images would supplement the current wording in the rulebook, see **Appendix A**, under the "Gameplay" section, with images including arrows that outline when and where the players place the cards. These additions would ease initial game progression and allow for an

alternative way of understanding for players who find that seeing images helps clarify the game flow.

The game developers could reorganize the order of the rulebook for optimization of game progression, with certain emphasis placed on elements of confusion found during playtesting. We recommend separating some rules into multiple steps to allow the reader to absorb each play action at a time, instead of multiple actions at once. We also recommend adding clarifications to the instructions that specifically distinguish between scenario and challenge cards to improve clarity. We recommend including a graphic placed after this clarification with a picture example of both card types and text explaining their differences. Explaining that only the player whose turn it is can take action on a scenario card using their method, while all players can collaborate on challenge cards would further ease progression throughout the beginning rounds of play. Tere Porter-Rawiri may send these recommended updates to Third Studio for their integration, as they are responsible for the rulebook and gameplay mechanics, to ensure that the recommendations align with their values and do not create any further unexpected confusion for the players.

Recommendation 2
Supplement the awareness of Aotearoa pests with a glossary

Justification

The intended role of the *Tiaki* game is to educate all types of players, not just those invested in pest management efforts. During playtesting with players who were less familiar with pest control, we found that some individuals lacked context regarding the specific harm caused by the pests mentioned in *Tiaki*.

Action

To improve the experience of the player during *Tiaki*, providing background to the game's purpose could create a positive impact on the educational value. We recommend adding a glossary to the rulebook to provide players with deeper context about the game's elements and purpose. This glossary could include information about each pest mentioned in *Tiaki* including when people introduced them to Aotearoa, why they are harmful to specific environments and native species, and a real image of the pest This glossary would be both visually and topically engaging, to initiate the player's interest An additional glossary could also include information about each method of pest control seen in *Tiaki*, with a brief definition and history of the method

associated with its corresponding card. Providing these glossaries would help players better understand the current applications that Tiaki is demonstrating. To incorporate these changes, Porter-Rawiri could improve and finalize the glossaries our team drafted (**see <u>Appendix N</u>**) and send them to Third Studio for their integration.

> ## Recommendation 3
> ## Clarify method and challenge card ambiguity

Justification

With *Tiaki* being a serious game, it must be both engaging and entertaining to be effective as an educational activity. Ensuring cohesiveness in the game's mechanics will provide a smoother, more positive experience for players. Some aspects of the game mechanics remain ambiguous, such as method and challenge card descriptions, which sometimes inhibits user understanding.

Action

To maximize the educational effectiveness, we recommend including bolded text on all method cards to easily identify their use to complete challenge cards. This bolded text should include which pests each card can target, which is currently on many, but not all method cards. Clarifying the impact of these cards will increase ease of

understanding and minimize delay of game (**see Figure 17**).
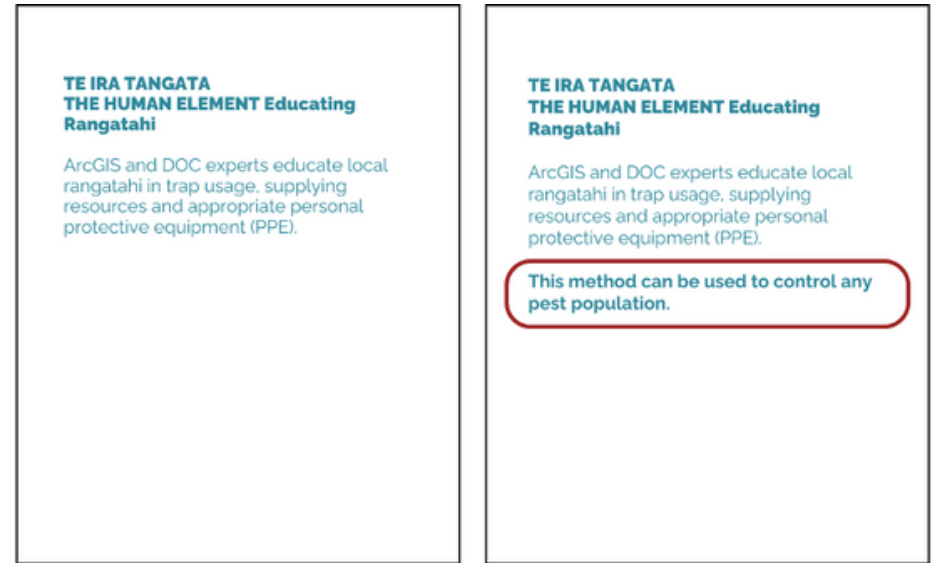
Figure 17: A current method card (left) with an addition of bolded text to indicate for which pest populations the method targets (right)

To incorporate these changes, Porter-Rawiri may draft these bolded instructions for each method card which do not already include them and send them to Third Studio for their incorporation.

Challenge cards, which encourage discussion by fostering a collaborative decision-making process about which method cards to place, are an essential element of discussion-based learning. These challenge cards currently instruct players "Respond with [X] method cards that build upon this milestone." We propose altering this wording to:

"Respond by unanimously convincing your table of [X] method cards to utilize to build upon this milestone. If the table is unable to come to a unanimous decision or you cannot play any method card, place 1 Pest Token to the board." (**see Figure 18**).
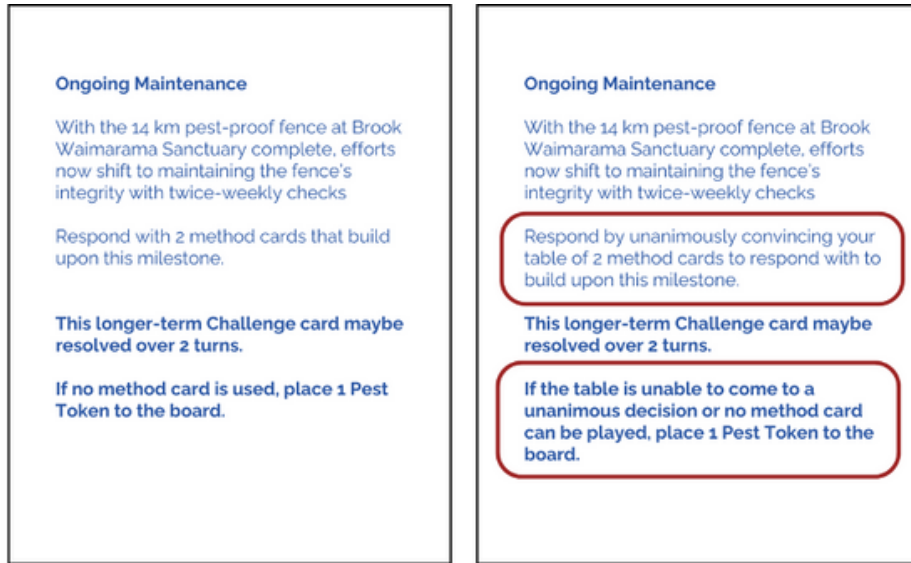
Figure 18: A current challenge card (left) with an addition of game mechanics requiring players to discuss and reach an agreement to continue play (right)

This change fosters a deeper engagement, which requires players to construct well-thought-out proposals for or against specific method cards, reinforcing confidence in their beliefs. By actively persuading others, players develop stronger critical thinking surrounding pest control methods, ensuring each choice is intentional rather than arbitrary. In instances where the players cannot reach a consensus, the inability to act has a meaningful consequence, encouraging players to refine their reasoning in future game discussions.

Recommendation 4
Add specific Varroa mite challenge cards

Justification
Currently, *Tiaki* includes method cards that specifically target Varroa mites, but it has few challenge or scenario cards where players can address them. To ensure these method cards can have a meaningful application in *Tiaki*, we recommend adding new challenge cards that explicitly require methods targeting mites.

Action
Porter-Rawiri could create new content for these method cards, ensuring they align with the existing mechanics and contribute to the current content of *Tiaki*. She could then request that these additions be made by Third Studio. These new challenges can create opportunities for players to further engage with mite-specific solutions, which may be lesser-known to some New Zealand citizens. Further, this will allow for greater equivalence of all methods' purpose during gameplay.

Recommendation 5
Explore options for future studies

Justification

The purpose of *Tiaki* is to educate about pest control management in New Zealand in an alternative and engaging way. As it is informative, implementing it into educational settings would greatly increase its potential impact on the population. For future research studies, contacting local educators to playtest the game and provide feedback to further enhance *Tiaki*'s experience would facilitate its use in those educational settings.

Action

Target the younger generation. This demographic was outside the scope of our study but is the best population for pest control education. Younger people are often more receptive to learning new ideas and practices and introducing these concepts early can significantly enhance pest control knowledge and actions, leading to increased protection for Aotearoa's native species.

Recommendation 6
Table of secondary recommendations

This table consolidates some secondary recommendations and small points that will further refine the game's experience (**see Table 5**). Some of these recommendations involve physical changes, while others are more operational.

Observation	Action
Players were unsure who should start the game.	Include an instruction to tell players which player starts the game. e.g. "The last player who went trekking starts, then play moves clockwise.
Lack of understanding with Māori terminology during gameplay.	Create a glossary of Māori terminology in the rulebook
Players switched their strategy after the initial decision with no consequence.	In the Game Set-Up of the rulebook, clarify what is meant by "decide which method strategy the group is aiming for" (Method one vs Method two) and label accordingly on the scenario cards.
Participants were unsure how to win or lose the game.	In the rulebook, clearly state the overarching game goal/ "win state" e.g. "Work with other players to decide on pets control methods to minimize pests and strengthen mauri. Collect 6 mauri tokens to win the game while avoiding the collection of pest tokens, as 6 pest tokens will cause the group to lose the game."
Images	Each card has small graphics in the corner that tell what pest they control/need to be controlled Each method card has a small graphic in the corner that tells what type of method it is.
Ethics	Using specific method cards can start events that need to be resolved. e.g. Using a poison method card can kill unintended taonga species, resulting in a scenario that requires players to use other methods of pest control
Post-game debrief is lacking	Add post-game discussion questions at the end of the rulebook for players to reflect on what they learned.

Table 5: Secondary recommendations

CONCLUSION

Tiaki is a meaningful tool that will inspire action in pest management through scenario practice and conversations in the safety of a controlled space. The game turns passive learning into an interactive experience and encourages individuals to gain a deeper understanding of the challenges facing New Zealand's native taonga species. Players can role-play difficult decisions to enact shared approaches to conservation while earning confidence in matters that might seem intimidating or controversial. Inspiring action is a crucial step in alleviating the burden of pest control in Aotearoa New Zealand.

This approach also aligns with global sustainability initiatives, including quality education (SDG4) and protecting and restoring life on land (SDG15), fostering a connection between engagement, knowledge, and real-world environmental impact (**see Figure 19**).

The success of *Tiaki* lies in its power to educate and inspire change in perspectives, turning awareness into guardianship of their environment. When individuals become actively engaged in learning, they are more likely to immerse themselves in issues affecting their own communities. By integrating emerging technologies with

Figure 19: United Nations Sustainable Development Goals 4 and 15: Quality Education and Life on Land (United Nations, n.d.)

collaborative learning, *Tiaki* turns conversations into interactive missions, empowering players to volunteer in pest trapping efforts, restore local habitats, and advocate for policies they believe in. Beyond the game, players can apply their newfound knowledge and motivation to encourage family and friends to participate in conservation efforts. Such experience and perspective sharing can create a ripple effect, shaping long-term attitudes extending beyond *Tiaki* and contributing to the mission of the Biological Heritage Organization and the Predator Free 2050 Initiative.

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TIAKI

AIM

The mauri of Aotearoa's natural habitats and taonga hangs in the balance. Players must strengthen mauri by protecting taonga and deciding how to manage pests.

Players work together to collect and combine method cards to gain taonga tokens which strengthen mauri according to given scenarios. At the same time, pests are posing challenges and if not controlled, will further weaken the mauri.

The game ends when players gain 6x taonga tokens on the board and mauri is restored; or when 6x pest tokens are received and mauri is weakened.

SET UP

1. Place the board on a flat surface. Shuffle the 3 sets of cards separately and place in 3 piles next to the board. ❶

2. Deal method cards to each player. Lay these cards on the table in front of each player for all to see. ❷
   - 2 players: deal 3 cards each
   - 3-4 players: deal 2 cards each
   - 5+ players: deal 1 card each

3. Turn over 1 scenario card and place on the board. ❸
   Collectively decide which method strategy the group is aiming for.

GAMEPLAY

At any time during the game:

- Players may collectively decide to decommission the chosen method strategy in favour of the alternative option on the scenario card. However, if player decide to do so, a pest token must be added to the board.

GAMEPLAY

On each player's turn:

1. Select up to 2 of your method cards to place on the board. ❹
   If the scenario is achieved in your turn, place the taonga tokens on the board ❺, and draw another scenario card.

2. Draw a challenge card ❻. With the other players, collectively decide how to respond to the challenge.

3. At the end of your turn, draw 2 method cards and lay them on the table in front of you.

Figure 20: Tiaki rulebook

A.1 Interview Questions for Game Designer

1. What sparked your interest in studying pest control research?
2. What was the main idea/goal you wanted players to take away after playing *Tiaki*?
3. When creating *Tiaki*, did you encounter any unexpected challenges or learn something that changed your approach to the game design?
4. Were there any key inspirations or resources that guided your decisions during development?
5. Were there any features you initially planned for *Tiak*i that didn't make it into the final version? Why?
6. Did you create *Tiaki* with a target audience in mind, if so, who?
7. Before settling on a board game, were there any other alternative learning forms that you thought could achieve the same goal?
8. What does success look like for you on a project like this?

A.2 Interview Questions for Game Developer

1. What is your age/ occupation?
2. Is there anything that you wish the game had included that it did not?
3. What suggestions do you have to improve the game's design, mechanics, or educational content?
4. How did you balance aesthetic design with functionality when designing graphics for this game?
5. What is your process for creating visually cohesive and engaging game components (board, tokens, cards, etc.)?
6. How do you test and refine your designs to ensure they resonate with the target audience, and what audience did you believe you were targeting for this game?
7. Was the collaborative aspect of the game something you were tasked with implementing, or was it an idea you came up with on your own? Can you expand on how you approached designing the collaborative element and its impact on the gameplay experience?
8. What does success look like for you on a project like this?

Subject: Invitation to Participate in Tiaki Board Game Playtesting Session

Tēnā koe _____,

We are a group of third-year Worcester Polytechnic Institute (WPI), USA engineering students: Abigail Rivers, Emma St Clair, Catherine Sauter, and Diego Winsor – working in Wellington in collaboration with Dr. Ocean Mercier of Victoria University of Wellington and Pat van Berkel of Pest Free Upper Hutt. We are working to review a board game called *Tiaki*.

We are excited to invite you to participate in a playtesting session of *Tiaki*, an educational board game exploring pest control in Aotearoa New Zealand.

Tiaki is a prototype game developed for the National Science Challenge: BioHeritage by the Novel tools and strategies for invertebrate pest control group. The game focus is wider than invertebrates as it also covers the control of predators included in Predator Free NZ 2050.
This playtesting session is part of a research initiative to assess the effectiveness of the *Tiaki* Board Game as a tool for learning about pest management in Aotearoa. Your participation will provide valuable insights into its effectiveness.

Session Details:

Sessions will take place at the Kelburn campus of Victoria University of Wellington. Our team will coordinate session dates so please respond directly to us gr-tiaki-c25@wpi.edu. Sessions will occur between now and 20 February, preferably during the time frame of 9am-5pm. The session duration is between 1 and 2 hours.

As well as playing through a game of *Tiaki*, participants will complete a brief pre-survey and a post-survey to provide feedback on the game's content, educational value and playability.

The session will be audio and visually recorded to enable subsequent analysis of participant interactions and feedback. Faces will not be recorded, just the playing table. All recordings will be treated with strict confidentiality, viewed only by the named researchers in this email, and used only for research purposes. All recordings will be deleted by January 2026. Recordings will be kept securely on password protected drives at Victoria University of Wellington. An example of the camera frame is provided below:

What to Expect:

You will join a group of 1 to 4 other participants to play *Tiaki*, with the game set up on a table in a classroom environment. If you would like to be scheduled to play with someone you know (who has also accepted this invitation), please note their name(s). Or if you have a group of people (aged 18 or over) that are interested in playtesting together then please let us know how many are in the group and what times would suit you all. All participants must read this information and consent to take part.

We would greatly appreciate your participation in this session. Your involvement will help refine *Tiaki* and contribute to its development. As a token of our appreciation we can offer you a gift voucher. If you are interested, we can also email you when outputs from the research are available (eg. research publications, game upgrade).

If you are interested, or have any questions, please respond as soon as possible. Send your reply directly to us via our email address: gr-tiaki-c25@wpi.edu. We will organise the playtesting groups, and contact you with possible dates, times and locations.

Warm regards,
Abigail Rivers
Emma St Clair
Catherine Sauter
Diego Winsor
gr-tiaki-c25@wpi.edu

APPENDIX D: FOLLOW-UP PARTICIPANT OUTREACH EMAIL

———,

Thank you for your interest in participating in our study! Playtesting sessions will be occurring beginning next week, February 3rd, and will be concluding on February 20th.

Please fill out this google form with your name, email address, other players you will be bringing with you (if applicable), and each time slot you will be available over this time frame.

Google Form: https://docs.google.com/forms/d/e/1FAIpQLSfgnQ4yrl17CykFZuPOhdO1h71NZhwTytHECWcZ2CwF12aq0A/viewform?usp=header

If you have any questions regarding how to fill out this form or if you are having trouble accessing the link, please let us know.
We will reply in the near future with your designated time along with instructions of where to arrive.
Thank you once again for your time, and we look forward to your participation.

Best,

Abigail Rivers
Catherine Sauter
Emma St Clair
Diego Winsor

gr-tiaki-c25@wpi.edu

In collaboration with Dr. Ocean Mercier, Victoria University of Wellington and Pat van Berkel, Pest Free Upper Hutt

Tiaki Playtesting Availability Form

Kia ora! Thank you for your interest in participating in the *Tiaki* board game playtesting session! Our team is grateful for your contribution to our study.

Please fill out this form with your name and ALL timeslots you would be available on the given dates. If applicable, please leave the names of participants you will be bringing with you.

Thank you once again for your time.

Name: _____

Email Address: _____

Participants Joining You (if applicable) with Their Contacts

Playtesting Session Availability

(Please check all time slots that you are available for.)

☐ Monday, February 3rd – 10:00 AM - 11:30 AM

☐ Monday, February 3rd – 1:00 PM - 2:30 PM

☐ Tuesday, February 4th – 10:00 AM - 11:30 AM

☐ Tuesday, February 4th – 1:00 PM - 2:30 PM

☐ Wednesday, February 5th – 10:00 AM - 11:30 AM

☐ Wednesday, February 5th – 1:00 PM - 2:30 PM

☐ Monday, February 10th – 10:00 AM - 11:30 AM

☐ Monday, February 10th – 1:00 PM - 2:30 PM

☐ Tuesday, February 11th – 10:00 AM - 11:30 AM

☐ Tuesday, February 11th – 1:00 PM - 2:30 PM

☐ Wednesday, February 12th – 10:00 AM - 11:30 AM

☐ Wednesday, February 12th – 1:00 PM - 2:30 PM

☐ Thursday, February 13th – 10:00 AM - 11:30 AM

☐ Thursday, February 13th – 1:00 PM - 2:30 PM

☐ Friday, February 14th – 10:00 AM - 11:30 AM

☐ Friday, February 14th – 1:00 PM - 2:30 PM

☐ Monday, February 17th – 10:00 AM - 11:30 AM

☐ Monday, February 17th – 1:00 PM - 2:30 PM

☐ Tuesday, February 18th – 10:00 AM - 11:30 AM

☐ Tuesday, February 18th – 1:00 PM - 2:30 PM

☐ Wednesday, February 19th – 10:00 AM - 11:30 AM

☐ Wednesday, February 19th – 1:00 PM - 2:30 PM

☐ Thursday, February 20th – 10:00 AM - 11:30 AM

☐ Thursday, February 20th – 1:00 PM - 2:30 PM

Is there anything else you would like us to know?

Subject: Tiaki Board Game Playtesting Session Confirmation

_____,

Thank you once again for your interest in our study! Based on your availability, we have scheduled you for the _____ playtesting session.

If you are able, please arrive 15 minutes prior to your session to the bottom floor of Ngā Mokopuna at Victoria University of Wellington, where two members of our team will meet you. This would allow you to have a brief introduction with our team and your fellow participant(s).

Ngā Mokopuna at Victoria University of Wellington: 42-50 Kelburn Parade, Kelburn, Wellington, Aotearoa

Kindly reply to this email to confirm your attendance. If you need to reschedule or have any questions, please let us know as soon as possible. We appreciate your participation and look forward to seeing you at your scheduled session!

Warm regards,
Abigail Rivers
Catherine Sauter
Emma St Clair
Diego Winsor
gr-tiaki-c25@wpi.edu

In collaboration with Dr. Ocean Mercier, Victoria University of Wellington and Pat van Berkel, Pest Free Upper Hutt

Tiaki **Playtesting Session Consent Form**

Purpose of the Study

Thank you for agreeing to participate in this playtesting session and associated surveys. We are a group of students from Worcester Polytechnic Institute working in collaboration with Professor Dr. Ocean Mercier and conservation advocate Pat van Berkel at the Victoria University of Wellington. The goal of this session, including playtesting and pre- and post-game surveys, is to evaluate *Tiaki*, focusing on its gameplay, mechanics, and user experience, to guide further development and improvements.

Procedures

As part of your participation, you will:

Complete a pre-survey to share your initial expectations and experiences with similar games or systems.

Participate in a playtesting session with 1–4 other participants, during which you will review the game's rules and play the game with the group.

Complete a post-survey to provide detailed feedback about your experience during the session.

Be observed during the session, which will include:

Video recording: A single video camera will record the session to capture gameplay interactions and group dynamics. This camera will only be recording the board and cards, no faces will be recorded.

Audio recording: An audio recorder will be present to record and document feedback and reactions.

A scribe: A member of the research team will take notes to supplement the recordings and capture observations in real-time.

Confidentiality

Your participation is voluntary, and our team will exclusively use all data collected, including survey responses, video and audio recordings, and scribe notes for research and development purposes. Our team will keep all identifying information, such as your name or image, anonymous in the analysis and final reports. The research team will store the data using secure password protected Victoria University logons with restricted access.

Voluntary Participation

Your participation is entirely voluntary. You are free to withdraw at any time without providing a reason. If you choose to withdraw, any data collected up to that point may still be used unless you request its removal.

Consent to Participate

By signing below, you agree to:

Participate in the playtesting session and surveys.

Allow the session to be recorded via video and audio.

Allow the research team to document your feedback for research and development purposes.

Participant's Name (Printed): _____

Participant's Signature: _____

Date: _____

Contact Information: _____

If you have any questions or concerns about this study, please contact:

Abigail Rivers, Emma St Clair, Catherine Sauter & Diego Winsor (in collaboration with Dr. Ocean Mercier and Pat van Berkel)

Worcester Polytechnic Institute Student Research Team

Victoria University of Wellington

gr-tiaki-c25@wpi.edu

Kia ora, and welcome to this playtesting session of the game *Tiaki*. My name is _____, and I will be the host of today's session. I would like to begin by extending a welcome and thank you for taking this time today to participate in this session. Myself and three of my peers from Worcester Polytechnic Institute, a university in the United States, working closely with Dr. Ocean Mercier and Pat van Berkel on assessing *Tiaki*'s effectiveness as an educational tool surrounding pest management in Aotearoa.

Tiaki is inspired by real pest management efforts here in Aotearoa. *Tiaki* is a collaborative game where you win as a team or lose as a team. You win by collecting six taonga (treasure) tokens before you collect six pest tokens. The goal of the game is to learn and work together to manage pests while protecting the native biodiversity.

Here is how today's session will run, totaling around 90 minutes:

Short Pre-Play Survey and Consent Form
First, please complete a consent form to participate in this study. Take your time and feel free to ask any questions. Following, we will ask each of you to fill out a brief survey. This helps us understand your initial thoughts and expectations.

Gameplay Session:
Once the surveys are complete, we'll introduce the rulebook and let you dive into the game. We would like you to initially learn the rules by reading the rulebook rather than us explaining it to you, so we hear from you whether it is clear or difficult to learn how to start playing the game. I will be at the table throughout the session to answer brief questions but remember, the key is to work together as a team to achieve the common goal. There are some open-ended aspects of the game, so don't feel surprised when you have to discuss certain cards with your teammates.

We will be both visually and audio recording this gameplay session, as outlined in the consent form. To preface, there will be no recording of faces; the recording will be of the game board and hands of participants throughout gameplay. Moreover, we will only use the video for research purposes and will not be published in any way. We will be deleting recordings after the project has concluded.

Post-Play Survey:

After the game, we'll ask each of you to complete a survey electronically using iPads or your phones. If you prefer, we also have paper copies available.

Gameplay Instructions:

 This session is all about collaboration and learning the game rules together. Please don't worry if you are unsure about anything, I will be here to help and answer any questions about the rulebook. As you play, please try to read each card out loud when you play them, and feel free to pause and have open discussions about the cards, especially if you are unsure of their meaning or how to use them.

A team member will be documenting key moments during gameplay to ensure everything is captured seamlessly.

After Gameplay:

At the end of the session, feel free to share thoughts or ask any questions of the game. There will be many opportunities to comment on positive aspects of the game as well as areas for improvement in the post-game survey. Your feedback is invaluable and will help us refine *Tiaki.*

Thank you for your time, and let's begin with the consent form and pre-play survey!

APPENDIX I: PARTICIPANT OBSERVATION TESTING FRAMEWORK

Evaluation Criteria
Scribe:
Start time:
End time:

1. Rules
    1.1. Are the instructions clear and easy to follow during setup and gameplay?
    1.2. Do any rules cause confusion or stall gameplay?
2. Gameplay Duration
    2.1. How long does a full session take, including set-up?
    2.2. Does the number of players significantly impact game duration?
3. Player Interaction
    3.1. What is the average level of enthusiasm throughout gameplay?

        Not enthusiastic at all
        Slightly enthusiastic
        Moderately enthusiastic
        Quite enthusiastic
        Very enthusiastic

4. Component Functionality
    4.1. Which cards cause confusion or stall gameplay?
    4.2. Are there unclear card instructions that disrupt flow?

Example Observational Notes Template

Category	Timestamp	Observation	Notes/Suggestions
Rules and Instructions	2:30	Players struggled to understand rule two of gameplay.	Clarify rule wording or provide a picture example.
Gameplay Duration	10:00	A five-player group exceeded two hours of gameplay to complete.	Suggest alternative rules for faster game progression.
Player Interaction	13:30	A five-player game had a conservation flow unrelated to the game.	Suggest a smaller player size for effective communication.
Component Funcationality	20:00	A scenario card caused repeated confusion during gameplay.	Suggest removal of scenario card from prototype.

Table 6: An example of the observational scribe notes taken during playtesting session.

APPENDIX J: PLAYTESTING ROOM & CAMERA SETUP

Example of game setup in a conference room in the Ngā Mokopuna building at Victoria University of Wellington.

Components include:
-*Tiaki* board and components
-Tripod
-Visual recording device (iPhone)
Audio recording device (TASCAM)

Example of frame captured by recording device during gameplay session. Camera positioned to only capture board, components, and players' hands.

Table 7: Playtesting session set-up and components

APPENDIX K: PRE-GAME SURVEY

Name: _____

By filling out this survey, we understand you have read the information email and consent to take part in this research.

Gender

Male
Female
Non-Binary
Prefer not to say

Age Group

18-34
35-49
50-64
65+

Ethnicity

Māori
Pākehā (NZ European)
Pasifika
NZ Asian
Other: _____

Q.K1
How familiar are you with pest control methods in Aotearoa New Zealand?

Not familiar at all
Slightly familiar
Moderately familiar
Quite familiar
Very familiar

Q.K2
Have you participated in community and/or environmentally based pest control? (e.g. trapping, monitoring etc.)

Yes
No

Q.K3
How often do you play board games/card games?

Never (0 times a month)
Rarely (1-2 times a month)
Sometimes (3-5 times a month)
Often (6-9 times a month)
Very Often (10+ times a month)

Name: _____

Q.L1

How familiar are you now, with pest control methods in Aotearoa New Zealand?

Not familiar at all
Slightly familiar
Moderately familiar
Quite familiar
Very familiar

Q.L2

How comfortable are you with the pest control methods Aotearoa New Zealand is currently using?

Very uncomfortable
Somewhat uncomfortable
Neither comfortable nor uncomfortable
Somewhat comfortable
Very comfortable

Q.L3

Please expand upon your answer to the previous question (e.g. key concerns, what your comfort level depends on).

_____
_____

Q.L3

Please expand upon your answer to the previous question (e.g. key concerns, what your comfort level depends on).

_____
_____
_____

Q.L4

How comfortable would you be with Aotearoa New Zealand adopting genetic technologies as a tool for pest control (e.g. gene silencing, genetic modification, etc.)?

Very uncomfortable
Somewhat uncomfortable
Neither comfortable nor uncomfortable
Somewhat comfortable
Very comfortable

Q.L5

Please expand upon your answer to the previous question (e.g. key concerns, what your comfort level depends on).

_____
_____
_____

Q.L6
Rate the following features of the *Tiaki* game:

Visual features
Not interesting at all
Slightly interesting
Moderately interesting
Quite interesting
Very interesting

Written Descriptions
Not interesting at all
Slightly interesting
Moderately interesting
Quite interesting
Very interesting

Ease of Gameplay
Not difficult at all
Slightly difficult
Moderately difficult
Quite difficult
Very difficult

Q.L7
How engaging were the player discussions held during the game?

Not engaging at all
Slightly engaging
Moderately engaging
Quite engaging
Very engaging

Q.L8
Which method card did you find the most interesting?
_____
_____
_____

Q.L9
Were your opinions about pest control challenged or changed during the *Tiaki* play session? In what way?
_____
_____
_____

Q.L10
Were there any memorable or exciting points? When and why?
_____
_____
_____

Q.L11
Rate your overall enjoyment/engagement while playing *Tiaki*.

Not enjoyable/engaging at all
Slightly enjoyable/engaging
Moderately enjoyable/engaging
Quite enjoyable/engaging
Very enjoyable/engaging

Q.L12

Why was the game engaging or not engaging?

_____

Q.L13

Please note any additional comments about your experience:

_____

Thank you for completing this survey!

If you are open to participating in a follow-up interview online or providing additional insights, we would greatly appreciate your contact information. Participation in an interview is entirely optional and your responses will remain confidential.

Note: We will only use this information to reach out regarding this study.

Please provide your preferred contact details below:

Email Address (optional):_____

Phone Number (optional):_____

Please tick the box if you'd like to be notified about future outputs from the research (e.g. publications, _Tiaki_ board game updates)
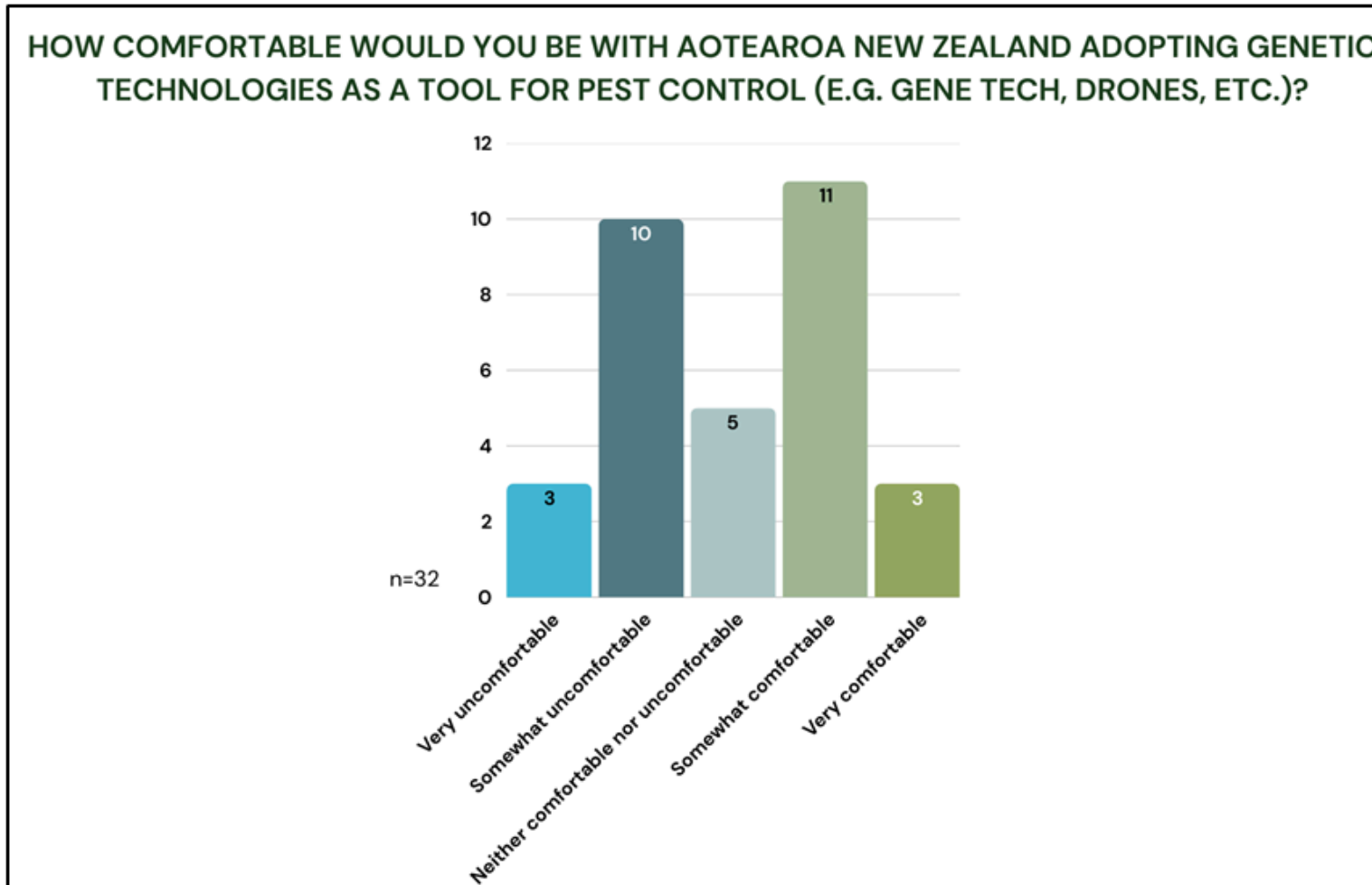
Figure 21: Participant response to question 4 on the post-game survey, n=32
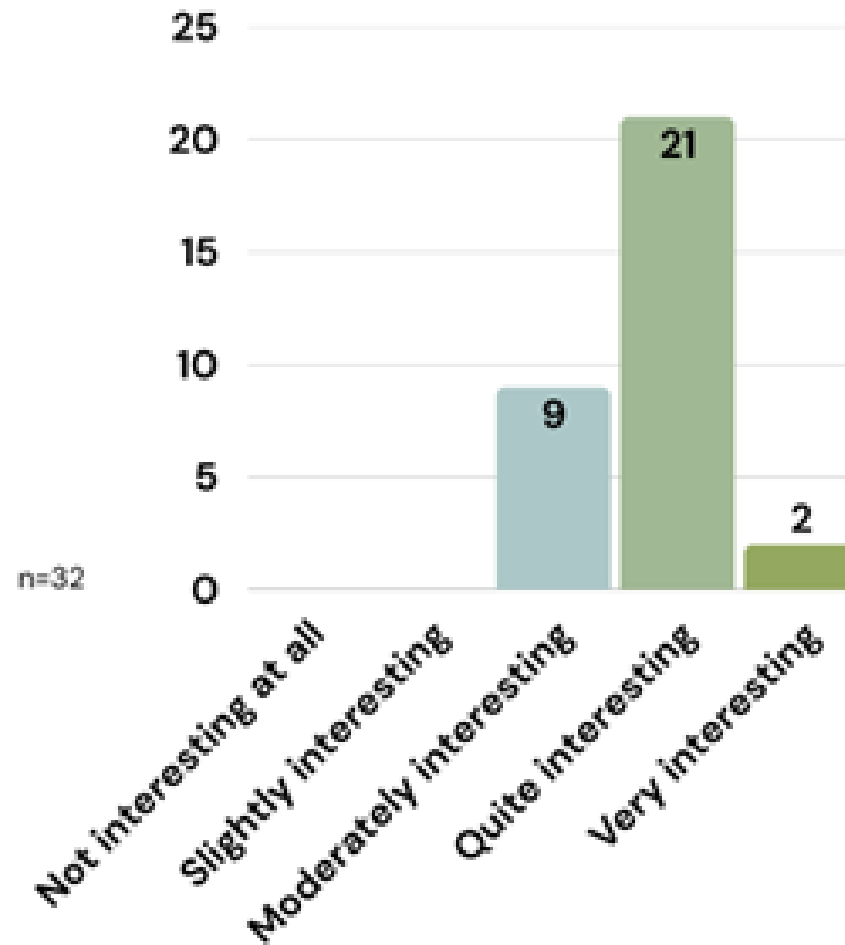
Figure 22: Participant response to question 6 on the post-game survey, n=32

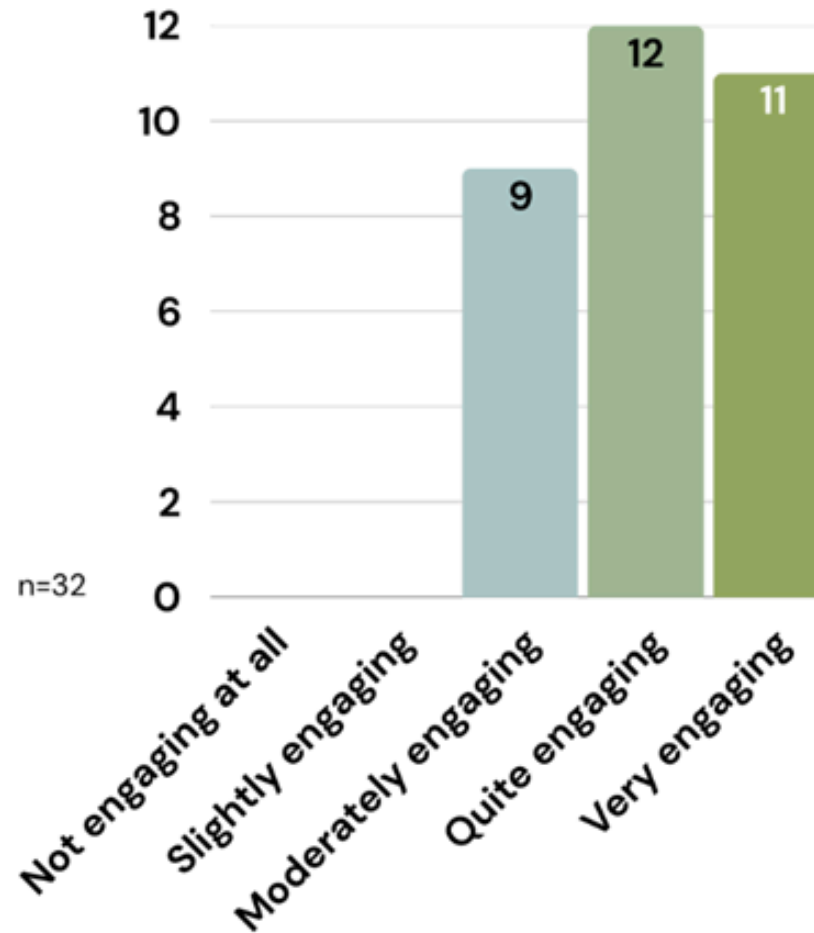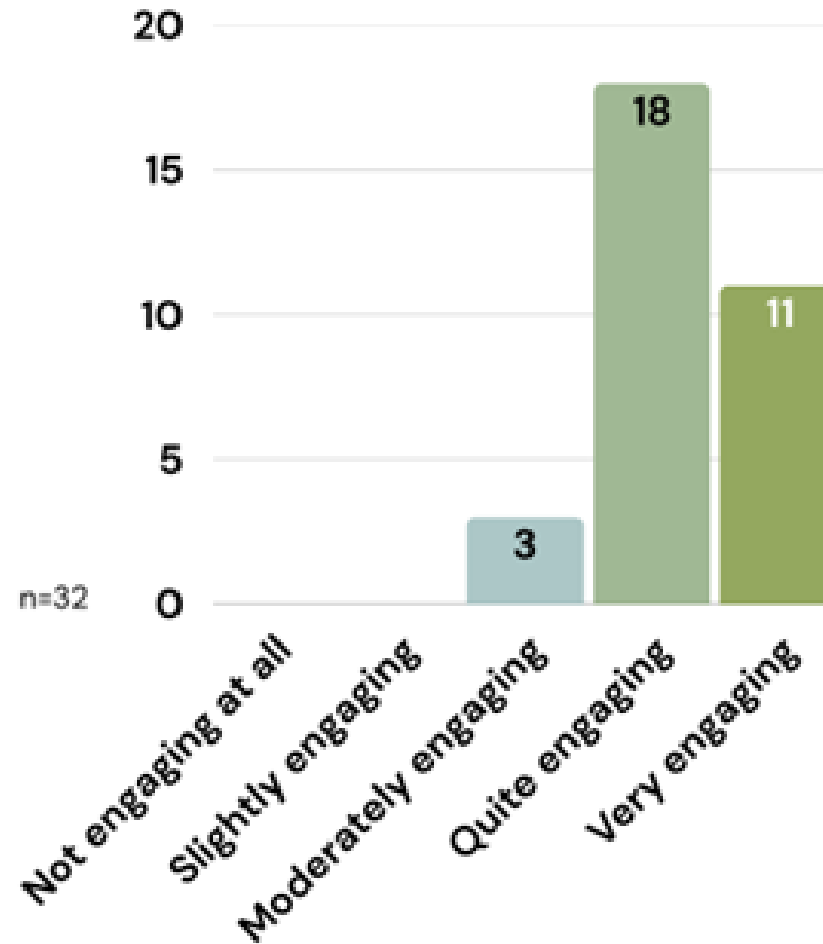*Figure 23: Participant response to question 7 on the post-game survey, n=32*

Figure 24: Participant response to question 11 on the post-game survey, n=32

"did make me consider the ways in which government...**measure their approaches**...it can't always be **'best practice'**"

"I found myself **less** worried **about winning** and more about the **approach/method**"

"from a **theoretical understanding** before playing and it was interesting to be in a **more decision making** position"

Figure 25: Notable quotes from participant responses to question 9 of the post-game survey

Figure 26: Example of a participant keeping their cards to themselves (Illustration: C.Sauter, 2025)

Figure 27: Example of a participant showing their cards in collaboration (Illustration: C.Sauter, 2025)

APPENDIX N: PEST AND PEST CONTROL METHOD GLOSSARY

COMMON PEST GLOSSARY

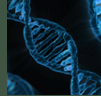| PEST	WHEN THEN WERE INTRODUCED	WHY THEY ARE HARMFUL
MICE	In 1824, introduced from Australia on ship by accident	They eat berries and seeds that take from bird food supply
MITES	Have been introduced over many centuries from UK, polynesia, and more	They have a parasitic relationship to native skinks and honey bees
POSSUMS	In 1937, introduced from Australia to build a fur industry	They prey on native bird eggs and chicks, such as kōkako, kiwi, and tūī
RATS	Beginning in 1300, rats have travelled over with settlers in their ships	They prey on native birds, lizards, fruits, eggs, and larvae
STOATS	In 1879, introduced to control rabbits that were destroying sheep pastures	They prey on native birds: kākāriki, kiwi, rock wren, and NZ dotterel
WASPS	Beginning in 1940, introduced by aircraft from europe, asia, and usa	They compete with native birds and lizards for food

Figure 28: Common pest glossary

PEST CONTROL METHOD GLOSSARY

METHOD	HOW IT WORKS
GENE TECH	Using gene tech techniques, like Single sex offspring selection, to target specific pests, but is currently still in development.
MĀTAURANGA	Using traditional Māori knowledge and cultural practices to manage pests while maintaining balance in the natural environment.
POISON	Using targeted, toxic bates to cotrol pest populations, but can accumulate in environment and harm non-target species.
TE IRA TANGATA (THE HUMAN ELEMENT)	Using community led efforts that encourage collective actions to target pests.
TRAPPING	Using traps and lures placed in pests' habitats to target pests, but can be labor intensive.

Figure 29: Pest control method glossary