Using Gamification to Support Positive Health Behaviour Change: A Kaupapa Māori Approach

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ABSTRACT

As our lives become increasingly technology-dependant, healthcare practitioners and researchers recognise the opportunities to deliver effective digital healthcare initiatives to improve patient outcomes. *Gamification* is one such technological approach to consider. While some important work has been done in gamification, to date, there have been few gamified healthy lifestyle intervention studies undertaken within an Indigenous or minority population. Therefore, this research extends the current knowledge of gamification with a focus on an Indigenous population.

Māori are the Indigenous People of New Zealand, and as in many other colonised countries, Māori are over-represented in obesity statistics; a factor which contributes to significant health inequities, such as a higher incidence of chronic illness among Māori people. Gamification may be an effective means of supporting positive lifestyle choices (e.g., increased physical activity) to reduce the prevalence of chronic illness. This research takes a Kaupapa Māori approach to address the research question: *How can gamification support positive health behaviour change?* Kaupapa Māori is a philosophical Māori-centric approach that ensures tino rangatiratanga (the right to self-determination). The research approach follows Māori tikanga (customary practices) and recognises the importance of Te Reo Māori (Māori language) and Te Ao Māori (a Māori worldview).

This research followed a design science research (DSR) process and consisted of two phases: Phase One was a prototype design phase, and Phase Two evaluated the prototype. Phase One involved a series of co-design hui (focus groups) to explore the social context and health aspirations of Māori and to ideate potential solutions. Phase One found that normative beliefs strongly influence effective gamification design preference for Māori and that culturally-tailored design is effective for Māori; a notion that contradicts previous Western-oriented gamification implementations. Phase Two consisted of a cross-sectional survey and regression analysis to evaluate the prototype designed during Phase One. Major findings from Phase Two show that three critical factors predict whether Māori users would use the gamified intervention: Perceived Ease-of-Use; Māori-Centric Design; and the use of Whakataetae (competitive) persuasive design strategies.

This research contributes to gamification literature by identifying the gamification elements that most significantly impact behavioural intention toward gamified health applications for Māori; knowledge that may be transferable to other Indigenous populations. The importance of implementing a competitive strategy contradicts previous literature on collectivist cultures and guides the development of future gamified

interventions. This research also contributes to theoretical and practical knowledge by demonstrating that effective persuasive strategies are not universal; Māori-centric design is a self-determined approach that keeps the needs of the target audience central to the design of a solution. This research provides theory driven practical guidelines for design processes and design decisions that are driven by the needs and aspirations of Māori.

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WHAKAPAPA

Tēnā koutou katoa
Greetings to you all
Ko Kurahaupō tōku waka
Kurahaupō is my canoe
Ko Taikorea tōku maunga
Taikorea is my mountain
Ko Rangitīkei tōku awa
Rangitīkei is my river
Ko Te Hākeke tōku tipuna
Te Hākeke is my ancestor
Ko Ngāti Apa tōku iwi
Ngāti Apa is my tribe
Ko Ngāti Kauae tōku hapū
Ngāti Kauae is my clan
Ko Parewānui tōku marae
Parewānui is my marae
Ko McLachlan rātou ko Waghorne, ko Jefferies ōku whānau
McLachlan, Waghorne, and Jefferies are my families
Ko Janice McLachlan rāua ko David Waghorne ōku mātua
My parents are Janice McLachlan and David Waghorne
Ko Graeme Jefferies tōku rangitira. No te Mawhera ia
Graeme Jefferies from Greymouth is my husband
E wha ō māua tamahine, Ko Naomi, rātou ko Katrina, ko Alice, ko Harriet
We have four daughters; Naomi, Katrina, Alice, and Harriet
No Kirikiriroa ahau engari e noho ana mātou ke Arapuni inaianei
I am from Hamilton, and now I live in Arapuni
E mahi ana ahau ki Te Whare Wananga ō Te Kura Raupapa,
I roto i te Kura ō Te Whakahaere me to Tairanga
I work at the Management School, in the School of Management and Marketing
Ko Dannie Jefferies ahau
I am Dannie Jefferies
Nā reira, tēnā koutou, tēnā koutou, tēnā tātou katoa
So, greetings, greetings, greetings to us all

I am a seventh-generation New Zealander of both Scottish Pākehā and Māori descent. My four-times great grandfather, Thomas Stickle was a whaleboat captain working the trade route between Cook Strait and Sydney. Originally from Scotland, Thomas Stickle married Turikatuku (Eihei) Hinetohea from the Ngāti Pariri hapū of Muaupoko, who occupied land on the southern shore of Lake Horowhenua. Thomas and Eihei Stickle had five children: Tiāki (Thomas), Hana (Hannah), Pene (Benjamin), John and William. Tiāki was born around 1857, and Hana was born two months before the signing of the Tiriti ō Waitangi. One of the Treaty signatories was Kāwana Te Hākeke, a chief of Ngāti Apa. Te Hākeke was Eihei Stickle's father – and my six-times great-grandfather.

Tiāki Stickle, eldest son of Captain Thomas and Eihei Stickle married Mary Kenny in 1858. They had nine children, including my great, great grandmother, Anna in 1859. In 1882, Anna Stickle married James Dickson McLachlan, a Scottish immigrant. They had eleven children; the second was my great-grandfather, Herbert Richard McLachlan, born in 1886. Herbert Richard McLachlan married Myrtle Ruby Vail, whose parents were both immigrants. Myrtle's father arrived in New Zealand in 1874 from Victoria, Australia, and her mother emigrated from Denmark as a child. Herbert and Myrtle McLachlan settled in Hamilton, New Zealand and had six children, five boys and one daughter. Their third son, Noel James McLachlan, married Audrey Lois Bramald of Eltham in 1941. These were my grandparents. My mother is Janice Dale McLachlan born in 1944, second daughter, and second child from six, five daughters and one son.

In 1963, Janice Dale McLachlan married a divorced man named Allan Richard Rush, they had three children together: my brother Allan Robert; me; and a younger brother, Morgen Richard. My father passed away in 1968 and my mother remarried and bore two more daughters, my half-sisters Sharnee and Storme. Our family lived itinerantly for ten years before returning to Kirikiriroa, Hamilton, New Zealand in 1975. I completed my education and worked for nearly thirty years before I began my tertiary education.

Researching my whakapapa and learning what it means to identify as Māori in Aotearoa today has been challenging and confronting. I acknowledge I have been raised with a Pākehā mindset in a society that is designed to promote the agenda of white middle-class policy makers. Through this journey I have been awoken to the challenges faced by generations of Māori. My research exploring both the Tiriti ō Waitangi, and the Māori wars has shown me how the belief system, culture and practices of Māori have been ignored. It is with immense pride that I witness a renewed commitment to culture, and the re-emerging popularity of Te Reo in the Māori and non-Māori people I have met

along this journey. My hope for the future is that Kaupapa Māori research will lead to Māori-centric solutions, and that projects such as this may be useful in highlighting Māori-centric research. Nina Scott, clinical director of Māori health at the Waikato DHB once said to me, "if you design *Hīkoi to Health* for Māori, it will work for all New Zealanders". It is this Māori-centric focus that has been retained throughout the current research project.

Whāia te iti kahurangi, ki te tuohu koe, me he maunga teitei

Seek the treasure you value most dearly:
if you bow your head, let it be to a lofty mountain.

CHAPTER ONE: INTRODUCTION

There are a substantial number of chronic health conditions which may be preventable if people would increase their physical activity and make healthy lifestyle choices. High body mass index (BMI>30) is a significant risk factor for many chronic diseases such as acute coronary syndrome, stroke, type two diabetes, chronic obstructive pulmonary disease, and some forms of cancer (Afshin et al., 2017). Internationally, obesity (BMI>30) rates have almost trebled since 1975 (World Health Organization, 2018) and there are a disproportionate number of Indigenous people who are impacted by these preventable diseases. The 2017 *Obesity Update* showed that Aotearoa, New Zealand adults have the third-highest BMI rates in the OECD; one in three (32%) adults have a BMI above 30% (Ministry of Health, 2018), and these rates continue to rise year-on-year (OECD, 2017). There are significant ethnic and socioeconomic differences in obesity rates in Aotearoa, New Zealand: 26% of Pākehā (New Zealand European) adults are BMI>30, compared to 65% of Pasifika and 47% of Māori (the Indigenous people of Aotearoa, New Zealand) adults (Ministry of Health, 2018).

Increasingly, health practitioners are looking toward technological solutions to support people to increase their physical activity and to make healthier food choices (Barclay et al., 2014; Mack et al., 2022) in an effort to minimise the incidence of obesity. Given the almost ubiquitous nature of mobile phones (Kamenetz, 2019; Mehta et al., 2021), smartphone applications to support healthy lifestyles have become common tools (Greenwood et al., 2017). The current research acknowledges that the feasibility of mHealth to deliver effective health behaviour change interventions has been studied previously (see Mehta et al., 2021; and Eyles et al., 2014), and therefore, the primary focus of this research is around *gamification* in an mHealth intervention to support healthy lifestyle changes.

Gamification has been defined as "the use of game design elements in non-game contexts" (Deterding et al., 2011, p. 10); it is a technological approach to making behaviour change interventions more engaging for users. Previous research has shown that gamification has been efficacious in supporting behaviour change (Allam et al., 2015; Hamari et al., 2018; Lienert & Patel, 2020; Rajani et al., 2021). The use of gamification to support health behaviour change is a nascent phenomenon, and to date, very little gamification research has been undertaken in a health context (Orji et al., 2014). While some important work has been done in gamification, to date, there are few gamified health studies undertaken within an Indigenous or minority population. Therefore, the current

research contributes to knowledge about gamification research in a health context and gamification effectiveness for Indigenous and minority populations.

This chapter begins by describing the Aotearoa, New Zealand context; *Section 1.1* explains some of the socioeconomic inequities facing Māori and describes these from the perspective of a colonial heritage, and breaches by the colonial state to honour its obligations to uphold Māori rights to self-determination. *Section 1.2* presents the purpose and the objectives of the current research. *Section 1.3* explains the significance of the research, and *Section 1.4* provides an overview of the research methodology and explains why a two-phased study was considered the most appropriate design. Finally, *Section 1.3* introduces the structure of the rest of this research project.

1.1 THE AOTEAROA, NEW ZEALAND CONTEXT

Ethnically, Aotearoa, New Zealand is a diverse country, and Māori are the Indigenous people. As with many Indigenous populations around the globe, the health of the Māori people is characterised by systematic inequities in social, economic and health systems (Reid et al., 2018). Oetzel et al. (2017) opines that the disproportionate allocation of the recognised social determinants of health such as income, employment, education, housing, and health care services, is underpinned by systemic racism emerging from historic colonial practices, and a failure by the New Zealand government to honour its obligations under Te Tiriti ō Waitangi; the founding treaty of Aotearoa, New Zealand.

Significant differences in health status between different groups within a population are seen across the globe. Collectively, these differences include classifications such as age, education, ethnicity, gender, geographical location, impairment, poverty, and socio-economic status (Reid & Robson, 2007). Health inequalities are described in terms of unequal disease burden or risk factors experienced by subgroups of the population. In Aotearoa, New Zealand, significant and enduring ethnic inequalities exist between Māori and non-Māori: Māori people generally have poorer health than non-Māori; the life expectancy of Māori is nine years less than non-Māori; and in New Zealand, Māori have 1.8 times the health burden of non-Māori (Ajwani et al., 2003; Hefford et al., 2005). Health inequities are the "differences which are unnecessary and avoidable, but in addition, are considered unfair and unjust" (Whitehead, 1992, p. 431). Health equity is defined as "the absence of systematic disparities in health (or in the determinants of health) between different social groups who have different levels of underlying social

advantage/disadvantage – that is, different positions in a social hierarchy" (Braveman & Gruskin, 2003, p. 254).

Health inequities exist between Pākehā (Europeans) and Māori; the origins of which are described in *Appendix A – Brief History of Aotearoa.* According to Theodore et al. (2015), it may be difficult to discuss health inequities experienced by Māori without first understanding the impacts of Aotearoa, New Zealand's colonial history, and the effect of systemic racism, oppression, and colonisation on Indigenous communities.

1.1.1 INSTITUTIONAL RACISM (SYSTEMIC)

Research suggests that racism may be a significant determinant of health inequities (Harris et al., 2006). Health equity is the concept of *fairness*; it is an ethical approach to resource allocation that ensures the minimum needs of all members of a society are met. It does not necessarily mean that health resources are shared equally; instead, it recognises that different resourcing allocation may be appropriate to ensure that different groups benefit from equitable health outcomes (Reid & Robson, 2007).

In Aotearoa, New Zealand, as in other countries with similar histories of colonisation, there are pronounced ethnic inequities in health systems between Māori people, and the racial majority, Pākehā (New Zealand European) population (Harris et al., 2006). Came (2012) stated that monocultural institutions (such as healthcare, educational, and justice systems), are designed to meet the needs of the Pākehā, and that institutional racism is rampant in health, education and governmental organisations to the extent that a "monocultural health policy [exists] that sometimes has some words around Māori health but the substance of it is still bio-medical and western and white" (Webby, 2017, para. 3). Came et al. (2020) agrees and further stated that systemic racism is evidenced by the "silencing of Māori voice in both policy and clinical practice" (p. 210).

Māori have been disadvantaged since the signing of Te Tiriti (the Treaty) the founding document of Aotearoa, New Zealand. *Appendix A – Brief History of Aotearoa* explores the history and colonisation of Aotearoa, New Zealand, and may go some way toward explaining why Western institutional structures fail to meet the needs of Māori as a consequence of recurring Treaty breaches (Theodore et al., 2015) that advance the aims of Pākehā (the European majority) and minimise Indigenous control and sovereignty (Rumbles, 1999), and therefore contribute to worsening health inequities (Came, 2012). In more modern times, the *Treaty of Waitangi Act 1975,* and its subsequent amendments, provides for the "practical application of the principles of the Treaty and for that purpose,

to determine its meaning and effect whether certain matters are inconsistent with those principles" (*Treaty of Waitangi Act 1975*, p. 2). One of the essential principles of the Treaty is the principle of tino rangatiratanga (Pihama et al., 2015).

1.1.2 TINO RANGATIRATANGA (SELF-DETERMINATION)

Article 2 of *Te Tiriti o Waitangi* (the Māori version of the Treaty of Waitangi) affirmed Māori rangatiratanga (sovereignty) and self-determination over Māori affairs and ancestral resources, while granting Māori people the rights and privileges of British subjects. Te Tiriti (the Treaty) "guaranteed the protection of *hauora* [health]" (Came et al., 2020, p. 209), yet the Crown has "systematically contravened [its] obligations" across the entire health sector (Came et al., 2020, p. 209). Came et al. (2020) also stated there has been colonial state sanctioned neglect of Māori health since the early 1900s, and an ongoing "undermining of Māori efforts to exercise authority over their own health" (p. 210).

Empowering Māori to determine their own healthcare needs, aspirations and priorities would create a sense of dignity, respect and equality (Chaplow et al., 1993). Tino rangatiratanga (the right to self-determination) is an essential concept in health practices and health research; it includes notions such as sovereignty, governance, and the inalienable right of Māori to make decisions *for* Māori. On a broader scale, self-determination maintains the individual's right to contribute to decisions about how health services might be provided for their benefit.

1.2 MĀORI HEALTH BEHAVIOUR CHANGE INTERVENTIONS

A sedentary lifestyle and poor food choices contribute to obesity, a significant risk factor for non-communicable diseases which are a leading cause of mortality and morbidity amongst Indigenous populations in New Zealand, Australia, and Canada (Crengle et al., 2014). According to Ministry of Health (2013), positive health changes such as improved diet, and increased physical activity can potentially alleviate risk factors for many preventable diseases.

Health care initiatives delivered over mobile networks (mHealth) have demonstrated efficacy in supporting health behaviour change (Eyles et al., 2016). For individuals motivated to improve their health, mHealth applications may offer useful functionality such as weight-loss and exercise programmes, as well as tracking activity and monitoring medication adherence (Marcus, 2011). Many health-oriented applications are developed with broad user appeal rather than designed to support a specific population group (Eyles et al., 2016), yet Crengle et al. (2014) illustrates the importance of Indigenous principles

and protocols throughout an intervention design project aimed at Indigenous people. In research involving Indigenous people, the World Health Organization (2019) stated:

> involving Indigenous Peoples, whether initiated by the community itself or by a research institute, needs to be organized [sic], designed and carried out in a manner that takes account of cultural differences, is based on mutual respect, and is beneficial and acceptable to both parties (para. 2).

Furthermore, the relationship between researcher and participants should be collaborative and attempt to balance the interests and responsibilities of the researcher and the Indigenous population (World Health Organization, 2019). Eyles et al. (2016) found no previous studies that co-designed a mobile health intervention, specifically for Indigenous groups, and since then, little research has been conducted in this space (Ni Mhurchu et al., 2019). It has also been suggested that health behaviour change interventions designed for the general population may be less effective for Indigenous and minority populations such as Māori and Pasifika people than for the dominant European population (Robson & Harris, 2007), yet in Aotearoa, New Zealand, Māori and Pasifika people are over-represented in obesity statistics (Ministry of Health, 2013). This highlights an important gap in knowledge about how to design culturally appropriate mobile health interventions within a co-design framework.

1.3 RESEARCH PURPOSE AND OBJECTIVES

High BMI is a significant issue worldwide; in many colonised populations, Indigenous people are over-represented in obesity statistics, and Māori are no exception. It is argued that a primary cause of high obesity rates for Māori stem from historic colonial practices and an inequitable health system. Health inequities may be addressed through the actualisation of tino rangatiratanga (the right to self-determination). Previous research will be presented in *Chapter Two* to show that using technologies to support people to increase their physical activity and to make healthy lifestyle choices may be an effective way to reduce the incidence of high BMI. One technology that may be efficacious is *gamification*.

The purpose of this research is to explore how gamification could support Māori people to increase their physical activity and to make healthy lifestyle choices. To achieve this purpose, a smartphone application will be designed and evaluated. Based on the research purpose, this thesis has three research objectives:

1. To understand the contextual elements that support engagement and continued use intentions in healthy lifestyle applications.
2. To identify the key design elements of gamification that would be most effective for Māori.
3. To determine the most effective design strategies to implement in Māori health applications.

1.4 SIGNIFICANCE OF THE RESEARCH

Despite the growing body of gamification literature across multiple domains, only a small number of gamification studies have been undertaken in the health domain, and a systematic literature review undertaken in June 2021 and presented in *Section 2.3*, found no studies that were undertaken in an Indigenous context[1]. Therefore, understanding how gamification can be integrated into health behaviour change interventions, specifically for Māori, offers an interesting and significant area for further study and would make a valuable contribution to knowledge. Consequently, the overarching research question for the current research is: ***How can gamification be used in Māori mHealth applications?***

The current research explored the unique aspects of the Māori social context and determined that as a collectivist culture, Māori social norms play a major role in an individual's willingness to engage with a gamified technology. Signifying that social support and the perceived expectations of referents impact behavioural outcomes in a Māori context. It also found that existing gamified health applications typically follow Western-design principles, which are designed for individualistic cultures, and commonly focus on *competition* as a central design theme; yet, the current research found that this single strategy is ineffective for Māori. This finding both confirms and extends extant literature on gamified health interventions.

The current research also contributes to knowledge by showing that co-design principles and a Māori-centric focus contributes to an effective design that meets the needs of target users. Māori-centric design principles were also found to be a significant factor for behavioural intention. Another major contribution of the current research is that the deployment of game design elements is not prescriptive, and researchers and gamified intervention developers should focus on identifying the appropriate persuasive strategy for each context, rather than on the game mechanics themselves. This finding contributes to both theoretical and practical knowledge.

1: The author acknowledges Sundborn et al. (2021) published a Māori-centric gamification study after the systematic literature search was conducted

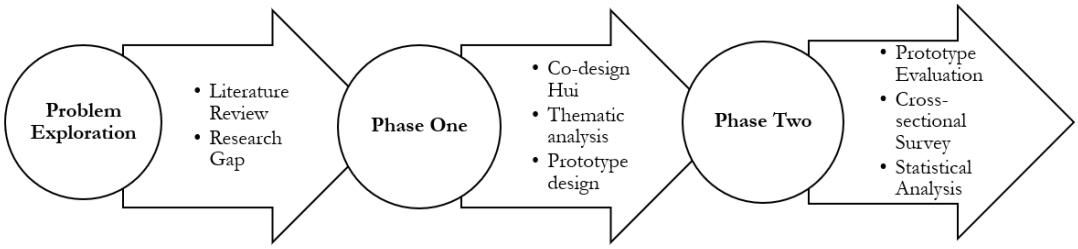
1.5 OVERVIEW OF THE RESEARCH METHODOLOGY

The current research focuses on the actualisation of tino rangatiratanga (the right to self-determination) by taking a co-design approach that empowers Māori to make decisions about developing a smartphone application to support Māori health aspirations by exploring and understanding what the needs of Māori are, and by co-learning how best to design an application to support Māori users to increase their physical activity and to support healthy food choices. It will do this through a technological approach called *gamification*.

The current research project takes a Kaupapa Māori (philosophical) approach the whole study is underpinned by Te Ao Māori (a Māori worldview); however, it also follows a design science research (DSR) process for identifying the research problem, then designing and evaluating an artefact to address the research problem. Kaupapa Māori and Te Ao Māori are more extensively discussed in *Chapter Four*, and the DSR process is explained in *Chapter Five*. This research follows a two-phased, mixed-methods design, as illustrated in Figure 1.1. Phase One consisted of three co-design hui (like focus groups). Each hui lasted between two and three hours, and in total 12 participants attended. Data collected during the hui included transcripts of the participant discussions, hand-drawn diagrams, and brainstorming notes created by the participants. This data was analysed using *Codebook Thematic Analysis* techniques. The output from Phase One included design guidelines for practitioners and a non-interactive prototype of an mHealth application called *Hīkoi to Health*. Phase Two of this research consisted of a cross-sectional survey (N=377). The purpose of the survey was to evaluate the gamified application to determine its perceived effectiveness, and to determine which design factors might predict an individual's use intentions. Phase Two employed statistical analysis techniques such as factor analysis, reliability analysis, correlations, and multiple regression analysis.

Figure 1.1

Overview of the research design



1.6 THESIS OUTLINE

The balance of this thesis is structured as follows: *Chapter Two: Literature Review* explores extant literature relating health behaviour change interventions and illustrates how little research has been conducted within Indigenous populations. It also introduces and defines the concept of gamification and gives an overview of previous gamification research across multiple domains before presenting a literature review specifically exploring extant health-based gamification research; it describes the process undertaken to identify the literature, it reviews the literature; and discusses the aims and effectiveness of each study. *Chapter Two* also introduces behaviour change theories identified within health-gamification literature and explains why an adaptation of the Reasoned Action Approach (Technology) is appropriate in the current research. It explores motivation theories and relates strategies for designing persuasive technologies to motivation and behaviour change theory.

Chapter Three: Research Gap and Questions critiques previous research and identifies gaps in previous research that explain how gamification can be used in Māori mHealth applications. The overarching research question is discussed, as are the questions that will guide the design of the current research. This research project is grounded in tikanga Māori (Māori cultural protocols) and Māori ways of doing things; *Chapter Four: Kaupapa Māori Methodology* introduces the concepts of Te Ao Māori (a Māori world view) and justifies that Kaupapa Māori (Māori approach) is an intentional effort by Māori academics to challenge Western research approaches in a way that normalises Māori ideologies, values and language within a culturally defined space (Pihama, 2012). *Chapter Four* also discusses the positionality of the researcher by describing the ontological, epistemological, and methodological assumptions.

The current research takes a two-phased approach to explore how gamification can be used to support Māori health: Phase One employs qualitative data collection methods to understand the issues and aspirations of Māori, and to determine the objectives of the solution; Phase Two uses a cross-sectional survey and statistical analysis to explain critical design factors that predict expected smartphone application usage. *Chapter Five: Phase One Research Design* reconciles Kaupapa Māori (Māori approach) with Design Science Research (DSR) and explains the DSR processes adapted for this research. *Chapter Five* describes the participant selection and data collection strategies and explains why a series of co-design hui (meetings) will guide an understanding of Māori health aspirations and participants'

experiences with health-related technologies. The justification for using the codebook thematic analysis approach is also discussed in *Chapter Five*.

Chapter Six: Phase One Findings follows the thematic analysis process outlined in *Chapter Five*. It presents five key themes: Theme One describes the Māori social context; Theme Two identifies the underlying beliefs of participants; Theme Three describes the participants interpretations and experiences of previously identified persuasive strategies; Theme Four presents participant discussion relating to game design elements; and, Theme Five presents participants' ideas for matching strategies with game design elements, and their ideas for target behaviours that could be designed into the *Hīkoi to Health* prototype.

Findings are discussed and compared with extant literature for each separate theme in *Chapter Seven: Phase One Discussion* before the smartphone application design process is described. The design process was iterative, and activities undertaken to ensure the prototype is representative of the participants' visions is also discussed. *Chapter Seven* presents the finalised prototype designs and explains how the prototype will be demonstrated and evaluated in Phase Two of the research.

Phase Two is focused on demonstrating *Hīkoi to Health* prototype to a broader Māori population and *Chapter Eight: Phase Two Research Design* describes the ethical considerations and the participant sampling techniques adopted to recruit 377 Māori participants to complete an online cross-sectional survey to measure respondents' perceptions about the prototype. This chapter describes the measures used and rationalises these based on extant literature and justifies the specific statistical analysis techniques used to identify the critical design factors that may predict expected application usage.

Statistical results are presented in *Chapter Nine: Phase Two Results and Discussion*; the current research uses multiple statistical techniques to analyse the results of the cross-sectional survey. It uses factor analysis to determine that scale items measure a single construct and that all items within a scale are statistically related to each other. Reliability analysis is conducted to assess how consistently the scale items measure the same construct. Correlation measures the strength of the relationship between variables, and multiple regression determines which independent factors account for unique variance in the dependent variable; or simply, which factors can predict expected usage of the *Hīkoi to Health* application. Descriptive statistics are used to determine whether a broader Māori population agreed with hui participants' design ideas. *Chapter Nine* also discusses the respondents' perceptions that the *Hīkoi to Health* design appears to meet the evaluation criteria. It shows that three critical factors appear to predict whether users would use a

test version of the application: Perceived Ease of Use; Māori-Centric Design; and the use of Whakataetae (competitive) persuasive strategies. The importance of a competitive design strategy contradicts previous literature on collectivist culture (such as the Māori social context) preferences, and *Chapter Nine* explains why this might be the case.

Chapter Ten: Conclusions, Limitations, and Future Research presents the theoretical and practical implications of this research: It contributes to knowledge by explaining the factors that most significantly impact the adoption of gamified mHealth applications for Māori, and it contributes to a growing body of knowledge on the co-design of healthy lifestyle applications for Indigenous populations. It contributes to practical knowledge by demonstrating that the identification of effective persuasive strategies must be determined for a target audience prior to the design of a solution; and it provides guidelines for design processes and design decisions that are driven by the needs and aspirations of the target audience. Finally, *Chapter Ten* acknowledges some of the limitations of the current research and presents how future research may mitigate some of these limitations.

CHAPTER TWO: LITERATURE REVIEW

This chapter explores extant literature relating to health behaviour change research. It begins by discussing health behaviour change intervention studies previously conducted in a Māori context. It should be noted that none of these are gamification studies. In *Section 2.2* gamification is defined and discussed in relation to business, education, and health. *Section 2.3* presents twelve studies identified from a systematic literature search; these studies are discussed, and four dimensions are presented that explain the focus of this prior research. *Section 2.4* presents the theoretical frameworks adopted in each of the twelve studies and explains why a modified Reasoned Action Approach is appropriate for this research. Motivation theory is an important aspect of gamification research, and *Section 2.5* discusses motivation theory in relation to the twelve studies identified. *Section 2.6* takes a broader look at gamification across multiple domains and explores the concepts of persuasive technologies and persuasive strategies; an area of gamification where little extant literature currently exists. *Section 2.7* relates the concepts of persuasive strategies to the health behaviour change theories presented in *Section 2.4*.

2.1 HEALTH BEHAVIOUR CHANGE INTERVENTIONS FOR MĀORI

Research in an Indigenous space should be collaborative and balance the interests and responsibilities of the researcher with the needs and interests of the Indigenous people central to the study (World Health Organization, 2019). Māori and other Indigenous and minority populations are over-represented in poor health statistics, and previous studies have shown that culturally-tailored health interventions could be effective for meeting the needs of these groups (Osei-Assibey et al., 2010; Robson & Harris, 2007). However, little research has been conducted in this space (Ni Mhurchu et al., 2019; Sundborn et al., 2021), and few studies have focused on collaboratively designing a mobile health intervention specifically for Indigenous groups (Eyles et al., 2016).

One notable example of collaborative design within Indigenous communities is the *OL@-OR@* trial which aimed to deliver health information and support to both Māori and Pasifika people via mobile devices (Ni Mhurchu et al., 2019; Ni Mhurchu et al., 2014; Te Morenga et al., 2018). The aim of *OL@-OR@* was to determine if a mobile health application would support adherence to healthy lifestyle guidelines adapted for Aotearoa, New Zealand. *OL@-OR@* used self-reported health measures such as physical activity, smoking, alcohol, and fruit and vegetable consumption. These measures were recorded at baseline and again at 12 weeks (Ni Mhurchu et al., 2019), and the study found that

although the co-design process led to a strong sense of ownership by its community owners, this did not translate into user engagement, as fewer than 25 percent of participants set a goal in the application. Furthermore, Ni Mhurchu et al. (2019) found no significant differences between control and intervention at 12 weeks and stated that *OL@-OR@* did not improve adherence to health-related behaviour guidelines amongst Māori and Pasifika individuals.

There are several possible explanations for the ineffectiveness of this programme: Initially, there may be participant selection bias, as users self-enrolled and were already in the predominantly healthy ranges for weight, activity, smoking, alcohol, and fruit and vegetable consumption and therefore self-reported high adherence to positive health-behaviours at baseline. Additionally, as the *OL@-OR@* trial was a community development, recruiters and community coordinators engaged regularly with participant clusters throughout the 12-week trials, which ran progressively over 11-months. This frequent contact may have led to increased compliance by both intervention and control groups, which ultimately led to a higher adherence for both groups (Ni Mhurchu et al., 2019).

Another reason not considered by the developers, was that the lack of user engagement (Ni Mhurchu et al., 2019) might be attributed to the absence of motivational theory in the design of *OL@-OR@*. Persuasive strategies such as competition and cooperation are increasingly designed into technologies, and may have a positive impact on both engagement and continued use intentions (Orji et al., 2014), which have a positive impact on efficacy (Orji, Nacke, et al., 2017). Additionally, gamification techniques are used to motivate and reward users for undertaking prescribed target behaviours such as goal setting and increased physical activity; for examples see: Chung et al. (2017); Hamari (2015); Hamari et al. (2018); Koivisto and Hamari (2014). *OL@-OR@* includes some game design elements, such as challenges and virtual rewards, but does not include any of the common triad elements: points, badges, or leaderboards (Deterding, 2015; Koivisto & Hamari, 2019). *OL@-OR@* is not categorised as an example of gamification as the inclusion of in-app challenges and extrinsic rewards is not the result of a *purposeful* gamification strategy (Rajani et al., 2019; White et al., 2019). Additionally, the *OL@-OR@* researchers have not published any gamification findings, nor signalled their intentions to explore the effectiveness of gamification in the future.

2.2 INTRODUCTION TO GAMIFICATION

In the last two decades, an increased uptake of computer gaming for entertainment has spawned the entire computer gaming industry that consists of game designers, developers, and players (Koivisto & Hamari, 2019). More recently, researchers, theorists, and software designers have been deconstructing games to an elemental level in order to understand their appeal, and to apply effective combinations of these elements in contexts other than computer games, such as business, education, and health (Deterding et al., 2011; Hamari & Koivisto, 2015a). *Gamification* has been trending in academic research since about 2010 and while the phenomenon is still relatively new, the commercial deployment of gamified applications has intensified in recent years (Maican et al., 2016). This subsection begins with defining the phenomena of gamification in *Section 2.2.1*, followed by discussion on gamification design elements (*Section 2.2.2*). Following this, *Section 2.2.3* explores some of the uses of gamification such as in business, education, and health.

2.2.1 DEFINING GAMIFICATION

The term *gamification* was coined in 2002 by British computer-gaming developer Nick Pelling to describe the use of game-like user-interfaces for commercial electronic devices (Marczewski, 2013). Later, Pelling (2011) wrote that he believed the adoption of new technology would increase if the device's interface appeared more game-like. In his own words, Pelling agrees his game-like devices and use of the word gamification was seven or eight years too early (Pelling, 2012). Six years later, Terrill (2008) described *gameification* [sic] as the major topic of the *2008 Social Gaming Summit*. By 2009 the use of 'game tactics' as a design element of customer loyalty interventions was being lauded as a solution for marketers (Sturgeon, 2009).

In the previous decade, several different concepts have been labelled as gamification, and many academics consider the label is misleading as it suggests the use of actual games, or even game theory, which is quite unrelated to gamification (Robson et al., 2015). Some marketers use gamification to describe the process of adding in-game advertising revenue models; Terlutter and Capella (2013) is one such example. Boinodiris and Fingar (2014) label role-playing and simulations conducted for training or problem-solving as gamification. Terms such as 'serious games', 'exergames', 'game-based learning', and 'playful design' have all been used to describe the inclusion of game-design elements in

digital applications (Alahäivälä & Oinas-Kukkonen, 2016), yet there is no consistency in defining gamification.

Since gamification first entered academic literature in 2010, there have only been a few attempts to define it (Dymek, 2018). Three peer-reviewed definitions of gamification currently contribute to the debate on its definition: "the use of game design elements in non-game contexts" (Deterding et al., 2011, p. 10); "a process of enhancing a service with affordances for gameful experiences in order to support users' overall value creation" (Huotari & Hamari, 2011, p. 19); and, "the process of making activities more game-like" (Werbach, 2014, p. 266).

According to Deterding et al. (2011), the defining characteristic of gamification is *non-gaming contexts*, and clarifies this by stating that by definition, gamification repurposes appropriate game elements in contexts where they would not typically be deployed, and therefore, the "only thing that 'non-gaming contexts' *explicitly* intend to exclude is the use of game design elements *as part of designing a game*, since that would simply be game design, not gamification" (Deterding et al., 2011, p. 12). In studies where an *actual* game is played, labelling the study as gamification may be inappropriate as, by definition, gamification occurs in a "non-game context", therefore a categorisation of 'serious games' may be more appropriate (Deterding et al., 2011). In addition, Deterding et al. (2011) explains that the term *serious games* is often used to describe "*full-fledged* games for non-entertainment purposes" such as simulations and military exercises (p. 3).

The concept of non-game contexts is one of the most contentious concepts in the debate on defining gamification. Werbach (2014) argues that games themselves can be made more game-like, and that 'non-game contexts' is not definitive of gamification. Deterding et al. (2011) separate gamification from serious games, yet much of the research undertaken in education and health gamification does include whole games, see Addy et al. (2018); Johnson et al. (2017); Lane and Prestopnik (2017); and Tong et al. (2017) for examples.

It may also be appropriate to reconceptualise gamification as a process of deploying game mechanics, and therefore focus on the *gameful* experiences of users. Huotari and Hamari (2011) build on the work of Werbach (2014), specifically recognising user experiences. Their own definition attempts to identify the essential elements of games, and then to anchor gamification within the context of service marketing, stating that customer value is an emergent property of the interactions of users with core services and, therefore, gamification fosters user interactions. What can be understood from these

definitions is that gamification is grounded in user experiences, and it uses design elements from computer games in non-gaming contexts.

2.2.2 GAMIFICATION DESIGN ELEMENTS

The following subsections offer a broad review of how gamification can be dissected and used to design behaviour change interventions. The literature showed that game design elements can be configured to influence behavioural outcomes (Kim & Werbach, 2016) as it has similar attributes to proven behaviour change interventions such as social connection, rewards, and techniques employed to increase user engagement (Cugelman, 2013). While there is literature describing how gamification can be adopted into behaviour change technologies, there is no definitive answer as to what constitutes *game-design elements*. This subsection begins by exploring game-design elements identified in gamification literature, followed by a criticism of the additive approach to adding game elements to existing technologies. This section also introduces the *Mechanics, Dynamics and Aesthetics (MDA) framework* (Hunicke et al., 2004) for discussing the game-design process. Finally, this section concludes with a discussion on gameful design (Deterding, 2015); a concept that leverages game-design elements in purposeful, user-centric experiences that leverage intrinsic motivation (Hamari et al., 2018).

2.2.2.1 GAME-DESIGN ELEMENTS IN GAMIFICATION LITERATURE

Deterding et al. (2011) stated that while game elements have been repurposed in non-game contexts for the purposes of defining gamification, it is helpful to consider game design is distinct from game-based technologies or practices. Therefore, for example, gamification excludes technologies such as game-controllers deployed as input devices. Deterding et al. (2011) also stated that there are various levels of game design elements including interface, mechanics, principles, models, and methods, as shown on Table 2.1.

For the purposes of identifying common game design elements across multiple studies, this study will initially focus on the first level of game-interface design patterns as described by Deterding et al. (2011). It is not common for gamification researchers to consider in-game dynamics or strategic design decisions in their discussions of game-mechanics. According to Deterding et al. (2011), game interface design patterns are "common, successful interaction design components and design solutions for a known problem in a context, including prototypical implementations" (p. 13). There is no definitive list of *common design components* for specific known problems and previous studies show the

five most identified game-design elements in literature are: points, badges, leaderboards, levels, and challenges.

Table 2.1

Levels of game design elements

Level	Description	Example
Game interface design patterns	Common, successful interaction design components and design solutions for a known problem in a context, including prototypical implementations	Badge, leaderboard, level
Game design patterns and mechanics	Commonly reoccurring parts of the design of a game that concern gameplay	Time constraint, limited resources, turns
Game design principles and heuristics	Evaluative guidelines to approach a design problem or analyse a given design solution	Enduring play, clear goals, variety of game styles
Game models	Conceptual models of the components of games or game experience	MDA; challenge, fantasy, curiosity; game design atoms
Game design methods	Game design-specific practices and processes	Playtesting, play-centric design, value conscious game design

Source: Deterding et al. (2011)

Hamari et al. (2014) identified ten game interface design elements commonly deployed in gamification: points, leaderboards, achievements/badges, levels, story/theme, clear goals, rewards, progress, and challenges. Subsequent studies by Seaborn and Fels (2015), and Deterding (2015) expand these elements further with the addition of avatars, time-pressure, collections, and virtual items. Deterding (2015) attempted to identify common game design elements across numerous studies. However, it could be argued that many of these studies present similar elemental concepts and apply different labels to them. Table 2.2 presents a summary previous studies and highlights the similarities between the concepts.

As expected, points, badges and leaderboards featured strongly in these studies: Points featured on all lists in some way. Seaborn and Fels (2015) listed reputation points and scoring systems as separate mechanics that increased social status and recognition for users. Similarly, badges appeared on all lists; however, it is interesting to note that Hamari et al. (2014) linked badges with achievements, and Deterding (2015) separated these concepts. Leaderboards were common across these studies, although Seaborn and Fels (2015)

referred to this concept as rankings. The concept of levels includes levelling up (Paharia, 2013) and unlocking (Deterding, 2015). Each concept refers to a series of stages of increasing complexity, through which a player advances by completing one level in order to reach the next (Lexico, 2019). This assumes that subsequent levels are both locked, and progressive. It is also difficult to distinguish between the concepts of quests (Seaborn & Fels, 2015) and challenges (Hamari et al., 2014), goals (Paharia, 2013) or missions (Deterding, 2015) as in all cases, the player is required to complete a prescribed task. Similarly, the concept of collections is popular in video games and requires the player to accumulate items to complete a set. In the case of computer-based games, there are invariably scarce and virtual items (Deterding, 2015) which can be collected, and in some instances, virtually traded (Seaborn & Fels, 2015). Table 2.2 also shows other identified game design elements such as onboarding, competition, avatars, collaboration and cooperation, community, time-pressure, ratings, turns, and enduring play. This section discussed the re-categorisation of concepts into synonymous groups and these concepts either were common across the studies as in the case of avatars (Deterding; Seaborn & Fels, 2015) and onboarding (Deterding, 2015; Paharia, 2013; Zichermann & Linder, 2010); or, they occurred on one list only such as community (Paharia, 2013), and ratings (Seaborn & Fels, 2015). While it is useful to compile a list of commonly deployed game design elements, gamification has been criticised for repeatedly applying these same few elements to any given problem (Deterding, 2015).

Table 2.2

Summarised game design concepts

Category	Combined concepts	Sources
Points	Points	Zichermann and Linder (2010), Paharia (2013), Attali and Arieli-Attali (2015), Deterding (2012), Mekler et al. (2015), Hamari et al. (2014), Deterding (2015)
	Reputation points	Seaborn and Fels (2015)
	Scoring systems	Seaborn and Fels (2015)
Badges	Badges	Zichermann and Linder (2010), Deterding et al. (2011), Paharia (2013), Attali and Arieli-Attali (2015), Deterding (2012), Mekler et al. (2015), Hamari et al. (2014), Seaborn and Fels (2015)
	Badges/Achievements	Hamari et al. (2014)
Leaderboards	Leaderboards	Zichermann and Linder (2010), Deterding et al. (2011), Attali and Arieli-Attali (2015), Deterding (2012), Mekler et al. (2015), Hamari et al. (2014), Deterding (2015)
	Rankings	Seaborn and Fels (2015)
Levels	Levels	Zichermann and Linder (2010), Deterding et al. (2011), Attali and Arieli-Attali (2015), Deterding (2012), Mekler et al. (2015), Hamari et al. (2014), Seaborn and Fels (2015)
	Levelling up	Paharia (2013)
	Unlocking	Deterding (2015)
Achievements	Achievements	Deterding (2015)
	Rewards	Hamari et al. (2014)
	Trophies	Seaborn and Fels (2015)
Feedback	Feedback	Hamari et al. (2014)
	Fast feedback	Paharia (2013)
	Engagement loops	Zichermann and Linder (2010), Deterding (2015)
Onboarding	Onboarding	Zichermann and Linder (2010), Paharia (2013), Deterding (2015)
Competition	Competition	Paharia (2013), Deterding (2015)
Quests	Quests	Zichermann and Linder (2010), Seaborn and Fels (2015)
	Clear goals	Deterding et al. (2011), Hamari et al. (2014)
	Goals	Paharia (2013)
	Challenges	Hamari et al. (2014)
	Tasks /Group tasks	Seaborn and Fels (2015)
	Quests/missions	Deterding (2015)
Avatars	Avatars	Seaborn and Fels (2015) Deterding (2015)
Collections	Collections	Deterding (2015)
	Virtual items	Deterding (2015)
	Limited resources	Deterding et al. (2011)
	Virtual trade	Seaborn and Fels (2015)
Story	Story/Theme	Hamari et al. (2014)
	Progression	Hamari et al. (2014)
	Virtual worlds	Seaborn and Fels (2015)
Collaboration	Collaboration	Paharia (2013)
	Cooperation	Deterding (2015)
Ratings	Rank	Seaborn and Fels (2015)

2.2.2.2 CRITICISMS OF THE ADDITIVE APPROACH OF GAMIFICATION

Some gamification has been criticised by academics and game developers as mere "*pointsification"* (Robertson, 2010 para.4), particularly when developers simply add points to mundane tasks in order to influence user behaviour (Kim & Werbach, 2016; Robertson, 2010; Seaborn & Fels, 2015). Robertson (2010) also stated that,

> What we're currently terming gamification is in fact the process of taking *the thing that is least essential to games* and representing it as the core of the experience. Points and badges have no closer a relationship to games than they do to websites and fitness apps and loyalty cards. They're great tools for communicating progress and acknowledging effort, but neither points nor badges in any way constitute a game (para. 4).

In this respect, pointsification is unsustainable in that it may encourage users to behave in a certain way, but this behaviour will likely be short-lived. Focussing on the addition of rewards has been shown to positively impact behaviour, but negatively impact user engagement and the sustainability of such activity (Denny, 2013; Hakulinen et al., 2013).

In contrast, Werbach and Hunter (2012) suggest that an additive approach to making gamification projects more compelling, suggesting that understanding the key patterns of game element combinations is the central task of gamification. Similarly, Paharia (2013) suggests that game elements can be layered over a business's core value propositions to drive engagement and loyalty. One major drawback of this prescriptive approach is the assumption that tasks will become more pleasurable simply by adding enjoyable game elements (Deterding, 2015). However, behaviour change theorists such as Deci and Ryan (1985) state that intrinsic motivators are more powerful and can lead to sustainable behaviour change.

One way to mitigate the effect of mere pointsification is by designing gamification interventions that focus on the construction of game-like experiences for users that consider their emotional and motivational experiences (Hamari et al., 2018). A lack of theory guiding gamification design has led some gamification researchers to appropriate Hunicke et al.'s (2004) Mechanics, Dynamics, and Aesthetics (MDA) model as the basis for understanding game-design interactions within computer games.

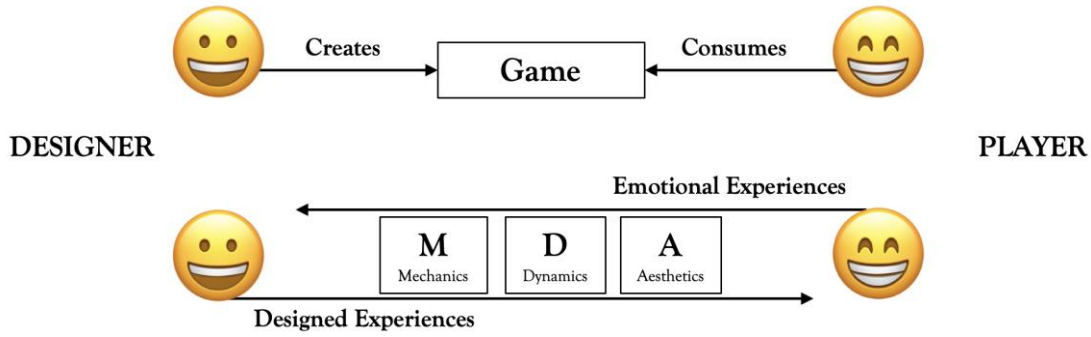
2.2.2.3 MECHANICS, DYNAMICS, AND AESTHETICS (MDA MODEL)

The *Mechanics, Dynamics and Aesthetics* (MDA) model from Hunicke et al. (2004) is shown in Figure 2.1. It has been used in gamification literature and described as a lens allowing developers to understand game design from the perspectives of both designer

and designed experiences, and from the player and their emotional experiences. The MDA model illustrates that game-design elements, or *mechanics,* can be configured to create in-game interactive behaviours, or *dynamics,* which in turn elicit emotional or *aesthetic* experiences for players (Hunicke et al., 2004). From the designer's perspective the focus is on combinations of mechanics to create dynamics which in turn lead to aesthetic experiences; from the player's perspective, games elicit an emotional response that drives an emotional connection with the game. Dynamics and mechanics are features of the game (Hunicke et al., 2004), and for this reason, user-centric design is critical (Deterding, 2015).

Figure 2.1

MDA model



Adapted and redrawn from: Hunicke et al. (2004)

Each of the elements in the MDA model will be discussed in the following subsections from the perspective of how they relate to gamification. The model is summarised on Table 2.3. *Mechanics* are the building blocks of the gamification system, *Dynamics* are the programmed interactions of the mechanics that prescribe in-application behaviour, and *Aesthetics* are emergent properties of the system, they are the emotional responses experienced by the user while they are interacting with the system. It is these emotional responses that can be leveraged for motivation and engagement (Hunicke et al., 2004; Mora et al., 2017; Robson et al., 2015).

Table 2.3

MDA model summary for gamification

Game Mechanics ➔	Game Dynamics ➔	Game Aesthetics
Building blocks of gamified systems Rules, procedures, and limitations of the game Common mechanics identified in gamification are: • Points • Badges • Leaderboards	Programmed interactions of mechanics Describes the behaviour of mechanics while game is in play. Generated by player inputs, outputs, and actions	Combinations of dynamics and mechanics are configured to elicit an emotional response. An emergent property of the interaction, such as: • Challenge • Self-Expression • Fellowship

Compiled from: Deterding et al. (2011); Hunicke et al. (2004); Mora et al. (2017); Morschheuser et al. (2018); Robson et al. (2015); and Ruhi (2015)

2.2.2.4 GAME MECHANICS IN GAMIFICATION

It has been argued that games are more like artefacts than media because the content of a game demonstrates systems behaviour and relies on the interactions of the players; unlike media, which is typically consumed by the player. Applying systems thinking to game design allows the research to abstract game elements across multiple levels (Hunicke et al., 2004). A game's *mechanics* are the rules, procedures and limitations of interaction imposed on the players within the structure of the game. These are the game components from which the game system is designed (Mora et al., 2017). Mechanics define the rules of play and prescribe the constraints of the game, Robson et al. (2015) stated that gamification mechanics are consistently applied across all players, and all instances of the experience. Every time a player interacts with the system, the mechanics behave in the same way. In a game of Monopoly, for example, the mechanics include the rules governing play; how the game board should be set up; rules for how each player token can move; when resources may be distributed; and, how a winner will be determined. Much of the gamification design literature reveals the recurring use of the same mechanics: points, badges, and leaderboards (Deterding, 2014; Morschheuser et al., 2018; Ruhi, 2015). It has been suggested that game mechanics are an abstract concept, because implementing mechanics into a user-interface is not gamification by itself (Deterding et al., 2011), but gamification emerges from the dynamic interactions of the game components.

2.2.2.5 GAME DYNAMICS IN GAMIFICATION

In the MDA model, *dynamics* describe the programmed interactions of the mechanics that prescribe in-application behaviour and the impact that users have on the system during play. As users interact with the system, the system responds in real-time in pre-programmed ways. Dynamics are an emergent property of player inputs, outputs and actions (Hunicke et al., 2004). For example, game mechanics and player interactions may be designed to encourage challenge, self-expression, or fellowship (Bunchball, 2015; Hunicke et al., 2004; Ruhi, 2015).

From the perspective of games, as a player progresses through the game the skill levels, the difficulty and variability of challenges increases. At the same time, player rewards may become more scarce, variable, and valuable. This results in the player needing to work harder to gain more valuable rewards. Intrinsically, this accumulative challenge is the fundamental dynamic of the game (Hunicke, 2005). Dynamics explain a user's attitude towards game mechanics (Matallaoui et al., 2016), however, while mechanics represent the building blocks of gamification, it is the combinations of mechanics and dynamics construct aesthetic experiences for players (Hunicke et al., 2004; Matallaoui et al., 2016).

2.2.2.6 GAME AESTHETICS IN GAMIFICATION

Aesthetics represent the overarching goals of a gamified system, and describes the anticipated emotional responses experienced by the player as they interact with the system (Deterding et al., 2011; Hunicke et al., 2004; Ruhi, 2015). Matallaoui et al. (2016) stated that evoking emotional responses in users as they interact with the gamified application increases motivation and engagement. Hunicke et al. (2004) determined that in the context of game design, there may be eight core games aesthetics which help illuminate why different games appeal to different people. These are shown in Table 2.4. Typically, games will include one or more aesthetics. For example, the game *Charades* emphasises the aesthetics of *Fellowship* and *Challenge* goals, and the game succeeds when "various players or teams are emotionally invested in defeating each other" (Hunicke et al., 2004, p. 3). Therefore, combinations of dynamics and mechanics are configured to elicit the response of *competition* in the game.

Table 2.4

Game aesthetics within the MDA framework

Aesthetic	Descriptor
Sensation	Game as sense-pleasure
Fantasy	Game as make-believe
Narrative	Game as drama
Challenge	Game as obstacle course
Fellowship	Game as social framework
Discovery	Game as unchartered territory
Expression	Game as self-discovery
Submission	Game as pastime

Compiled from: Hunicke et al. (2004)

In a gamification implementation, aesthetics are planned user-experience outcomes that meet the developer's expectations or desired outcomes of the application, such as collaboration, motivation and engagement (Ruhi, 2015). While the MDA model has been leveraged in gamification design, criticism of this model in gamification research is its limited generalisability to gamified applications. This is because it specifically relates to digital game play and gamification, by definition, excludes games. The MDA model is simply a descriptive framework for conceptualising game design elements and offers no particular insight into the ideal prescriptions for effective gamification design (Ruhi, 2015).

More recent studies show that technology design strategies implemented in software and user-interface design may offer a more appropriate framework for discussing gamification aesthetics. These strategies are discussed later in *Section 2.6: Persuasive Strategies in Technology*. However, it is important to recall that the value of the MDA model to gamification research is its utility in explaining the construct of game design elements. Huotari and Hamari (2012) consider that rather designers should focus on the overall user-experience regardless of the service delivery system, and to consider designing processes that make the target behaviour more engaging; an approach that has been labelled *gameful design*.

2.2.2.7 GAMEFUL DESIGN APPROACH

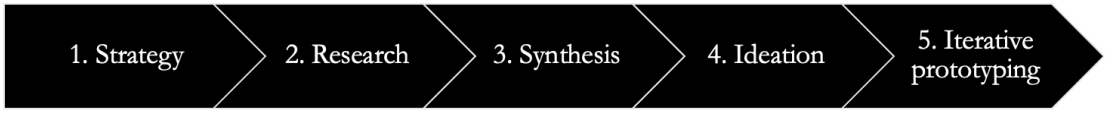
Gameful design is a purposeful approach to intervention design that suggests rather than creating behavioural-outcome focused applications that extrinsically reward actual behaviour completions, designers should take a *process-focussed* approach that ensures gamified interventions are intentionally designed to make target behaviours more engaging (Hamari et al., 2018). Acknowledging that behavioural-focused gamification is

easier to implement since actual behaviour completion is easier to recognise and reward extrinsically, Hamari et al. (2018) also stated that process-focussed design is more challenging as it requires the whole user-journey toward the target behaviour to be more purposeful as it leverages intrinsic motivation.

Research concludes that to be effective, gamification should consider the users' motivations, the purpose of the application, and adopt a gameful design framework (Knutas et al., 2019) such as Deterding's "five steps in gameful design" (2015, pp. 315-320). Gameful design is a prescribed, user-centric design process (see Figure 2.2) that focuses on designing enjoyable experiences for users in specific contexts with unique challenges and specific outcomes (Deterding, 2015).

Figure 2.2

Gameful design process



Reconceptualised from Deterding (2015)

The gameful design process framework (Deterding, 2015) assumes that the design of a gamified application is not a mish-mash or pick-and-choose from a list of options, but to consider that each specific gamified instance exists in its own unique time and space context. It recognises that what works in one context may not transfer to a different location or audience, and furthermore, that specified target behavioural outcomes present their own constraints of time, technology and governance (Rogers et al., 2012). The emergent properties of gamification systems such as enjoyment and motivation stem from the user's interaction with the entire system, not simply the gamified elements, and therefore, it is critical to take a systems-wide approach to design (Deterding, 2015).

It has been stated previously that mechanics are selected in combinations to create in-game dynamics, and that aesthetics are the planned user-experience outcomes that support changing user's behaviour, such as increasing motivation or engagement (Ruhi, 2015). Hamari and Koivisto (2013) have stated that gamification attempts to change *motivation* rather than attitude or behaviour directly, and yet behaviour change theory as presented in *Section 2.4*: *Health Behaviour Change Theories in Gamification* suggests that *attitude* is a predictor of behavioural intention. Another factor which is being explored in health behaviour change literature is the use of gamification from the perspective of persuasive

technologies which attempt to change the behaviour and attitude of the user (Hamari & Koivisto, 2013). As gamified systems are inherently computer-based persuasive technologies, it is appropriate to consider persuasive strategies from the software design discipline (Cugelman et al., 2011) to support the prescribed aesthetics of a gamified application.

2.2.3 GAMIFICATION DOMAINS

Gamification has been deployed in education, logistics, health, government, marketing, and business to motivate, engage and support behavioural change (Morschheuser et al., 2018; Nacke & Deterding, 2017; Oppong-Tawiah et al., 2018; Orji & Moffatt, 2018). This section gives a brief overview of two domains in which gamification studies have been undertaken: business and education. Health is another important domain for gamification, and studies relating to gamification in health are presented in *Section 2.3*.

2.2.3.1 GAMIFICATION IN BUSINESS

Historically, self-directed workplace games have been played by employees to reduce the tedium of repetitive tasks (Burawoy, 1979). Henri de Man (1927) stated that work activities intrinsically possess emotional elements, and that workers can find some meaning in any assigned work activities, and that a "certain scope for initiative which can satisfy after a fashion the instinct for play and the creative impulse" (pp. 80-81). One example is a case where an employee manually wrapped 13,000 light bulbs a day: "she found her outlet for creative impulse, her self-determination, her meaning in work by varying her wrapping movements a little from time to time" (de Man, 1927, p. 81). In early research on job satisfaction, Roy (1959) coined this scope for initiative as "the game of work" (p. 60). Building on Roy's research, Burawoy (1979) found that games serve purposes beyond relieving boredom and encouraging satisfaction, arguing that games were tolerated, and even subtly encouraged, as games can lead to increased productivity and increased employee satisfaction.

Managers are consciously implementing game structures and dynamics into the workplace to manipulate employee behaviour (Mollick & Werbach, 2014). To date, very little research has explored enterprise implementations of gamification as an employee-facing management tool which is distinct from customer-facing functions such as marketing (Mollick & Werbach, 2014). Global employers such as IBM, Microsoft, Nike,

Google, Deloitte and Disney, endeavour to increase employee engagement by embedding game-design elements into business processes (Kim, 2016).

Deloitte's *Maverick* training programme uses gamification principles to teach employees problem-solving skills and to encourage innovation and foster engagement among employees (Kumar & Raghavendran, 2015). For Deloitte, additional benefits of the *Maverick* programme are reduced training times, improved on-boarding processes and increased engagement in training tasks (Dale, 2014). In another example, researchers from IBM found that awarding points, levels and leaderboards within their social network led to increased accuracy of data entry, and increased employee interaction with the system (Farzan et al., 2009; Mollick & Werbach, 2014).

Games in the workplace can relieve the tedium of repetitive tasks, this may contribute to increased employee satisfaction (Burawoy, 1979). However, employee satisfaction is typically not the primary goal of business. Gamification also has the potential to support improved performance of employees through incentivising positive behaviour (Mollick & Werbach, 2014). Design elements such as rewards, points and leaderboards are associated with games, and they are also commonly deployed in employee behaviour change interventions. Examples of the business use of game design elements include rewards for exceeding quota and ranking sales personnel (Deterding et al., 2011).

2.2.3.2 GAMIFICATION IN EDUCATION

While little academic research has been undertaken in the business context, this is not the case in the education domain (see Callan et al., 2015; Hamari & Koivisto, 2015a). A recent study showed that a gamified learning application led to improved engagement with learning tasks, as well as increased student motivation and task enjoyment (Hamari et al., 2014). Massive Online Open Course applications such as *Coursera, Lynda.com, Open2Study,* and *Udemy* offer online learning platforms that include game-design elements such as completion badges, achievements and points; thereby, demonstrating that gamification is already well implemented within online education (Maican et al., 2016). Based on the argument that conventional learning activities are not inherently interesting, Attali and Arieli-Attali (2015) stated that gamification is a "disruptive force in education" (p. 57) as games are intrinsically fun, and therefore, introducing game-like elements should make learning activities more attractive.

Previous gamification in education studies indicate positive results. However, researchers also note that small sample sizes and short study time-frames indicate these

findings may be impacted by the novelty of the implementation (Attali & Arieli-Attali, 2015; Callan et al., 2015; Deterding et al., 2011; Hamari et al., 2014). Gamification has been criticised for focussing on extrinsic rewards such as badges when engagement should be intrinsically motivated (Hakulinen et al., 2013). It has been shown that extrinsic elements such as badges, real-time feedback have a positive effect on performance and motivation for practical tasks, and a negative effect on written assignments and in-class activities (Attali & Arieli-Attali, 2015; Domínguez et al., 2013). In contrast, Denny (2013) found that badges impacted positively on the duration of student engagement and quantity of contributions, whereas the quality of contributions was reduced when badges were introduced. This suggests that students are driven to acquire badges over sustained periods although the quality of the output does not reflect duration of activity. It is interesting to find that different groups of students responded to the same mechanics in different ways (Hakulinen et al., 2013), suggesting a relationship between personal characteristics and preference for gamification mechanics.

2.3 GAMIFICATION IN HEALTH

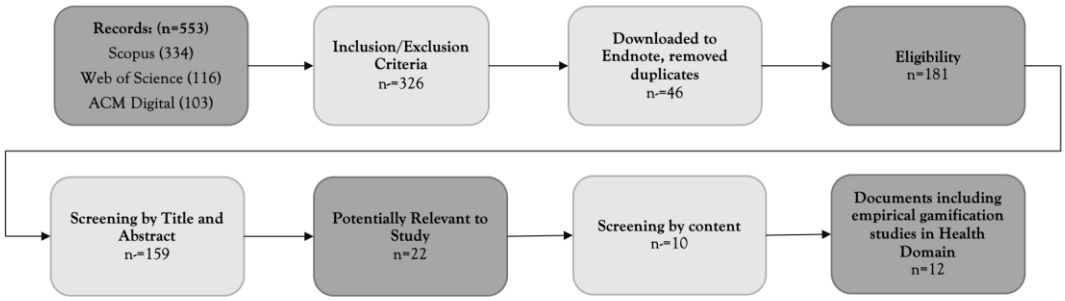
The deployment of gamified health applications has intensified in recent years (Eysenbach et al., 2017; Hamari et al., 2018; Nacke & Deterding, 2017) as healthcare practitioners and researchers recognise the opportunities to deliver effective and tailored initiatives to improve patient outcomes. A survey of gamification literature was conducted to identify empirically driven gamified health studies. The purpose of this literature search was to obtain a broad understanding of previous research in gamified health and to identify the factors that may contribute to the design of a gamified application. The literature search was also useful to identify key behaviour-change theories in gamification, as one criticism of previous gamification research is its lack of guiding theory. Additionally, the literature search was a key step in understanding the extant literature to learn what gamified health applications had previously been designed and evaluated.

A major challenge in identifying relevant literature was the diverse use of the term 'gamification', which produced many studies that were labelled gamification but referred to concepts such as exergames, serious games, and health games. This study defines gamification as the use of game-design element in non-gaming contexts (Deterding et al., 2011) and therefore, any literature that describes serious games, in-app games, mini-games, exergames or experiments in which an actual game is played are not relevant in the context

of this study. The keywords: gamification and health were selected for this search. Figure 2.3 shows the steps followed in this literature review.

Figure 2.3

Systematic review process



When searching the databases, there is no specific requirement for publication date; gamification was only defined in 2011 and all health gamification studies since then may be relevant. This search undertaken on 17 June 2021 yielded 553 initial studies:

> *TITLE-ABS-KEY (gamification AND health) AND (LIMIT-TO (PUBSTAGE, "final")) AND (LIMIT-TO (DOCTYPE, "ar")) AND (LIMIT-TO (SUBJAREA, "COMP") OR LIMIT-TO (SUBJAREA, "MEDI")) AND (LIMIT-TO (LANGUAGE, "English"))*

This review aims to identify high-quality research that specifically relates to the use of gamified technologies within a health context. Therefore, the following inclusion criteria are applied: Peer-reviewed papers; Papers that contain the key words in the title, abstract or keywords; Papers that contain primary data collection. The search is limited to articles in English and published in journals broadly categorised as relating to medical, health, computers, or technologies, and excludes all meta-review literature. In total, 326 studies were excluded from further evaluation as they did not meet eligibility criteria. Excluded studies include Shepherd et al. (2015) which was excluded as although the study has the keyword gamification, the intervention is a serious health game; and Glover et al. (2021) was excluded because it is not a gamification study.

Records including citation information and abstracts were imported into Endnote for screening, and it was noted the records contained 46 duplicates, these were removed, leaving 181 eligible studies. Studies were manually screened by title and abstract in Endnote for relevance. Relevant studies were those that met the objectives of the search in that the title and or the abstract discussed gamification in the context of health. Studies screened out in this step included studies that mention the word health but were undertaken in a non-health

context such as education. Studies where it was obviously not gamification as defined in *Section 2.2.1: Defining Gamification* were also screened out. In total, 159 studies were excluded leaving 22 potentially relevant studies.

The remaining 22 studies were manually screened for content and relevance. Finally, 12 studies were selected. Each of these studies collects primary data on an intervention that contains game design elements in a non-game health context. The studies undertake primary data collection, and the focus is on gamification. These studies are different to the other 540 studies initially identified in the original literature search as each is specifically a gamification study in the context of health, and not a study that uses mobile health technologies or in-app games to deliver a health intervention without specifically describing their use of gamification. This decision was made because Deterding et al. (2011) defines gamification as occurring in a non-game context, and therefore games are specifically excluded from their definition. As the scope of the review is very focused, it was not surprising that only twelve gamified health studies were identified in the literature; these studies identified in the systematic review process are summarised in Table 2.5.

Most of these studies relate to increased physical activity or weight loss and indicates that gamification may have a significant impact on health behaviour change. Other examples of gamification studies were: engagement with health-related information (Allam et al., 2015; White et al., 2019) and a smoking cessation programme (Rajani et al., 2021). A number of different research designs are represented in these studies: *pilot studies* such as Chung et al. (2017); *random control trials* as in Allam et al. (2015); Lienert and Patel (2020); Mamede et al. (2021); Patel et al. (2019); and *cross-sectional surveys* such as Hamari et al. (2018); Hamari and Koivisto (2015b); Koivisto and Hamari (2014); Meixner et al. (2020); Orji et al. (2014); Rajani et al. (2021); and White et al. (2019).

A study by Orji et al. (2014) found that tailoring persuasive technologies for individuals is a critical aspect of behaviour change design. This study also identified that persuasive strategy preference has been largely ignored by health researchers yet is prevalent in computer-gaming research. Orji et al. (2014) examined the perceived persuasiveness of ten persuasive strategies on gamers segmented by personality type. This study mapped common game mechanics by persuasive strategy. A limitation of this approach is the necessity to conduct psychometric testing on individuals, and this is not necessarily practical. Another limitation of the Orji et al. (2014) study is that is does not consider distal variables such as culture, age, gender, nor whether normative beliefs, attitude, or behavioural beliefs moderate the impact of persuasive strategies.

In a web-based gamified intervention study designed for rheumatoid arthritis patients, Allam et al. (2015) found that social support and gamification indicated a likelihood of increased physical activity. It found that patients with access to a gamified intervention showed a higher rate of interaction with the application which led to reduced reliance on healthcare system as people were able to self-manage their access to information and support from peers and support staff. A significant limitation of the study is that it was a web-based application that required users to connect to the internet for access. Allam et al. (2015) did not consider technological barriers to computer usage or accessibility. Another limitation is that although the geographic context was very specific (the Italian-speaking area of Switzerland), the participants are not Indigenous people, and therefore, its relevance in this research may be limited.

In a study designed to increase the daily step count of otherwise healthy adults with a body mass index of greater than 25 (BMI=kg/m^2), Patel et al. (2019) found that competition motivated users to significantly increase their physical activity over time, and that the effect of cooperation on user's actual behaviour diminished over time. Patel et al. (2019) also found that the relationship between competition and cooperation differed depending on the degree of personal connection to other users of the intervention. Explicitly, that competition may be more effective than cooperation when participants are not socially connected. One of the significant issues with the Patel et al. (2019) study is that all 602 participants are college educated employees of the same company, suggesting a lack of generalisability, particularly with regards to socioeconomic inequality.

The *Milk Man* mobile application (White et al., 2019) was designed to support new fathers to have a positive attitude toward breastfeeding through information sharing. The app focussed on peer discussions and a library of informational resources. The use of gamification was limited to points, badges, and leaderboards, suggesting that gamification was not a significant design consideration, and findings in this study do little to extend gamification knowledge. Feedback from participants suggested that gamification elements were not encouraging.

Table 2.5

Empirical studies examining gamification in health

Author	Study title	Method	Theoretical framework	Game design elements	Findings
Koivisto and Hamari (2014)	Demographic differences in perceived benefits from gamification	Cross-sectional survey n=195 Fitocracy users	Theory of planned behaviour	feedback, achievable goals, achievements, progress, social interaction, and encouragement. Badges, levels, points	Context of exercise-related gamification. Increased age is associated with decreased perceived ease of app use. Females perceive social elements more beneficial Females more motivated by social factors Perceived Usefulness diminishes over time Social features are beneficial for engagement and stickiness
Orji et al. (2014)	Modelling the efficacy of persuasive strategies for different gamer types in serious games for health	Cross-sectional survey n=1,108 computer gamers Instrument = storyboards	BrainHex model: Gamer types	Persuasive strategies: praise, cooperation, competition and comparison, reward, simulation, personalization, customisation, self-monitoring, and suggestion Mechanics: achievements, leaderboards, status, levels, physical goods, virtual items, reward schedules, lottery, free lunch, points, extinction, disincentives, loss aversion, bonuses	Competition, comparison, suggestion and self-monitoring may be the most effective strategies for health behaviour change Reward and praise are not as effective as might be expected, and may be ineffective for some people depending on personality. Familiarity with other players has a negative association with competition Cooperation may be less effective than competition Tailoring is important Praise and rewards are less effective than expected and may be removed without negative impact on effectiveness Self-monitoring and suggestion are important design considerations
Allam et al. (2015)	The effect of social support features and gamification on a web-based intervention for Rheumatoid Arthritis patients: Randomized controlled trial	RCT n=157 Adults with Rheumatoid Arthritis	Not specified	Points, badges, medals, rewards, collecting, rank, leaderboards, real-world prizes	Social support empowers patients. Gamification led to increased engagement and usage of application. Gamification and social support had positive impact on physical activity, suggesting that competition and comparison can drive motivation.

Author	Study title	Method	Theoretical framework	Game design elements	Findings
Hamari and Koivisto (2015b)	"Working out for likes": An empirical study on social influence in exercise gamification	Cross-sectional survey n=200 Fitocracy users	Expanded theories of reasoned action and planned behaviour	Points, level-ups, achievements, badges, quests, challenges, feedback, likes	Social influence is not confined only to the perceptions of the individual about the beliefs of relevant others. Social factors are an important antecedent for sustained behaviour and use intentions of motivational technologies. Continued use intentions were positively associated with the continued exercise intentions. Study did not directly measure how different gamification elements affect social influence
Chung et al. (2017)	Tweeting to health	Pilot study n=12 Twitter and Fitbit users	Not specified	Challenges, real-world prizes	In-app gamification was limited to challenges. Compliance with wearing the Fitbit was sustained throughout the study, and challenges had a positive impact on physical activity. High rates of dietary recording were reported. Two groups of participants, healthy weight and overweight. Overweight group were all female, suggesting a potential gender bias
Hamari et al. (2018)	Gamification, quantified-self or social networking? Matching users' goals with motivational technology	Cross-sectional survey n=167 Users of Heia-Heia app	Social comparison theory; self-determination theory; goal setting theory	Goals, badges, medals, points, leaderboards	There is a positive association between the perceived importance of both gamification and social networking features, with users who are outcome focused, who set themselves easier goals, and who are more inclined to prove themselves. The importance of social networking features is negatively associated with avoidance orientation towards goals. The importance of quantified-self features is associated with users who are outcome-focused and oriented towards mastery and setting specific goals.
Patel et al. (2019)	Effectiveness of Behaviourally Designed Gamification Interventions with Social Incentives for Increasing Physical Activity among Overweight and Obese Adults Across the United States: The STEP UP Randomized Clinical Trial	RCT n=602 Adults with BMI 25+	Not specified	Points, levels, goal setting, feedback, goal-pledge, loss of points, status, support sponsor, collaboration, competition	Gamification + competition = highest physical activity levels during the whole trial Gamification + support, and Gamification + collaboration both had higher step counts than the control groups, although both declined over time. Each significantly increase physical activity over time Effect of social incentives varied by degree of personal connection
White et al. (2019)	Gamifying breastfeeding for fathers: Process evaluation of the milk man mobile app	Cross-sectional survey n=586 Father focused breast-feeding information	Not specified	Points, badges, leaderboards Points awarded for completing in-app activities such as accessing information and contributing on forum	Gamification can be a powerful motivator with this target group; however, care needs to be taken to better understand how its inclusion may impact those who reported not enjoying it, and the app should include the option of being fully functional without participation in the gamification

Author	Study title	Method	Theoretical framework	Game design elements	Findings
Lienert and Patel (2020)	Patient Phenotypes Help Explain Variation in Response to a Social Gamification Weight Loss Intervention	RCT n=196 recruited as pairs Adults with BMI 30+	Not specified	Points, levels	Study showed that gamification and close personal relationship had a positive impact on weight loss, and that these impacts continued for the whole study. Also, support from primary care physician = demotivation
Meixner et al. (2020)	Personality Traits, Gamification and Features to Develop an App to Reduce Physical Inactivity	Cross-sectional survey n=808 Customers of health insurer	Personality system interaction theory	Feedback, rewards, levels, incentives, points, progress Mechanics identified from interviews n=36	Gamification elements considered relevant were feedback, level ups, immaterial rewards, monetary incentives, point accumulation, and progress towards the goals of fitness improvement, more active lifestyles, and more health sports. Level advancement, collecting points and progress were considered irrelevant to nature activities Gamification elements that address social interaction like comparing one's own results with others or competitions were not considered to be relevant by study participants
Mamede et al. (2021)	Combining web-based gamification and physical nudges with an app (MoveMore) to promote walking breaks and reduce sedentary behaviour of office workers: Field study	RCT n=298 + 4x questionnaire Office workers	Social cognitive theory Nudge theory	Leaderboards, achievements, badges, experience points, rewards, social support, comparison, challenges, team goals, real-world prizes (charitable donations) Real world nudges Fitbit devices provided	Significant increases in step-counts for intervention, however not maintained during nudge phase Gamification + social support and comparison appears to be effective Observed small but clinically significant effects on + physical activity and – sedentary behaviour
Rajani et al. (2021)	Impact of gamification on the self-efficacy and motivation to quit of smokers: Observational study of two gamified smoking cessation mobile apps	Self-reported survey n=116 2 apps	Technology acceptance model	Diaries, tracking, levels, sharing, motivation cards, goal setting	Gamification associated with increased self-efficacy and motivation to quit smoking Frequency of gamification influences user engagement Perceived frequency of gamification features was statistically significantly associated with change in self-efficacy and change in motivation to quit

White et al. (2019) also stated that a limitation of their study is its lack of generalisability. Specifically, it lacks an Indigenous focus, and participants were typically more highly educated than the general population. Additionally, as they were recruited from antenatal classes, they were already engaged in childbirth, thereby potentially introducing an unintentional bias in the findings.

In a weight-loss intervention, participants were recruited in pairs, a friend or family member needed to also commit to participating. Lienert and Patel (2020) found that people with a close personal relationship residing in the same location (such as spousal partners) typically lost more weight when using the gamified intervention than friends or family teams that saw each other less frequently. Thus, suggesting that social connection is potentially a critical factor in health behaviour change. In all instances, participants using the gamified intervention lost more weight than participants who had the support of a health care professional, and those who were in the control group. Gamification was limited to points and levels, and Lienert and Patel (2020) found that participant teams with frequent contact and were more motivated to comply with the behavioural expectations suggesting that peer pressure and social norms have a significant impact on behavioural outcomes in gamified interventions. A limitation of this study was its relatively small sample size, as only 98 pairs of participants were recruited. Using only two game design elements (points and levels) suggests that the primary aim of the research was not to study gamification, thereby limiting this study's ability to extend gamification knowledge. Additionally, there is an over-representation of white, wealthy, educated women in the data thereby limiting its generalisability to lower socioeconomic populations.

A study of under-active adults was conducted to identify which incentives would support them to become more physically active. It found that participants preferred monetary incentives, suggestions for activities, receiving feedback, and reminders (Meixner et al., 2020). The study also found that 97% of participants who did not meet the World Health Organization standards for physical activity (at least 150 minutes per week) wanted to increase their fitness, mobility, and to undertake more outdoor activities, yet could not explain why existing health applications were not used by participants. Meixner et al. (2020) also found that motivation for behavioural control was more important in behaviour change than personality traits. There are limitations to this research; the Meixner et al. (2020) study combined mobile application design features and gamification and therefore it is difficult to interpret which elements the researchers

considered to be gamification, as some elements are not usually associated with games; for example*, knowledge about healthy lifestyle*, and *link with the bonus program*.

Another recent study exploring the lack of physical activity in office workers found that gamification and social support significantly increased daily step count (Mamede et al., 2021). This study combined a gamified intervention with physical nudges (such as signs placed around the office) to promote behaviour change, however the step count increases in the gamification phase were not maintained in the nudge phase, and some participants reported reduced overall physical activity during the nudge phase. This finding needs to be presented in context: the baseline step counts for participants averaged 10,138 before either phase was implemented, this is above the daily average for active persons of 10,000 steps per day. This suggests an unintended participant bias, as the participant pool was populated with physically active rather than sedentary persons, and therefore, an increase over time might not have been sustainable.

Comparing the efficacy of two smoking cessation applications, Rajani et al. (2021) found that goal-setting was perceived by participants as the most useful gamification element, and progress dashboards were the most frequently accessed. The study also found an association between frequency of use of gamified elements and a user's efficacy and motivation to quit smoking. Rajani et al. (2021) suggests an association between gamification and user engagement: by providing real-time feedback on performance through game elements such as badges, levels, and tracking, gamification may enhance competency and increase confidence in participants' self-efficacy and motivation to quit. A limitation of this study is that the differences between the applications is not completely clear. Both applications used may contain gamification elements, and future studies should explore game elements isolated to one application.

This subsection has presented findings from 12 health gamification studies that have shown that gamification has a significant impact on behavioural outcomes, and that a combination of gamification and social support is most effective. Social support and gamification lead to increased self-confidence, self-efficacy, and motivation to perform a target behaviour. Normative beliefs impact behavioural intentions, and this peer pressure impacts an individual's motivation to comply with the target behaviour. This specifically occurs when application users have a close, pre-existing social relationship.

These studies show that persuasive technologies are fundamental in behaviour change interventions, yet to date, little research has been undertaken into persuasive strategy preference. Studies indicate a relationship between close personal connections

between users, and positive behavioural outcomes. Specifically, *competition* leads to decreased physical activity when users are socially connected; and *cooperation* may be more effective within close familial relationships. However, there are few studies that explore preference for persuasive strategies across a general population: Patel et al. (2019) discuss only competition and cooperation; and Orji et al. (2014) identify ten persuasive strategies, yet only explore them by analysing the personality traits of computer gamers.

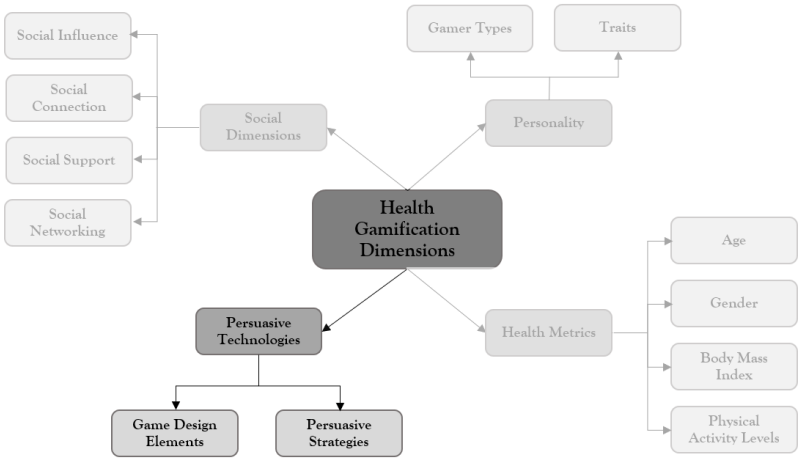
There are multiple gaps in the literature that should be addressed. Although multiple studies claim to research the use of gamification in health care initiatives, few contribute to gamification literature. Several studies explain that gamification has an impact on increased physical activity, and then fail to define their use of game design elements, or simply mention two or three elements such as points, badges, and levels. In most of these instances, the gamification appears to be additional and not the core focus of the study.

Several studies were situated in a specific geographical region; however, none of these studies had an Indigenous focus. In multiple studies, the researchers mentioned that there were built in participant biases and an over-representation of higher socio-economic categories. In some studies, most participants were wealthy, white, and well educated, and therefore, the findings may not be generalisable to the general population, let alone an Indigenous or minority population. None of these studies explored using gamification to support increased physical activity or improved health outcomes for Indigenous persons, or people living with significant health inequalities.

Each of the twelve studies discussed in this section has been categorised by the author into four key aspects: social dimensions, personality, health metrics, and persuasive technologies. Each of these aspects is presented in Figure 2.4.

Figure 2.4

Aspects explored in previous health gamification literature



2.3.1 SOCIAL DIMENSIONS IN HEALTH GAMIFICATION RESEARCH

One of the key aspects of health gamification studies is effect of social factors such as social influence, social connections, social support, and social networking on intervention design and effectiveness. It would be difficult to discuss the effects of gamification without including social dimensions since the constructs of gamification rely on social interaction (Hamari et al., 2018). For example, the effectiveness of game mechanics such as points, badges, leaderboards, and levels (see *Section 2.2.2: Gamification Design Elements*) relies on individual users comparing themselves to other users. Hamari et al. (2015) stated that social influence predicts attitude and continued use intentions, and that the more friends a user has in the intervention, the stronger the effects are. Furthermore, Hamari et al. (2018), and Hamari and Koivisto (2015b), suggest social networking is an important feature in health behaviour change technologies as humans rely on the feedback and encouragement received via social interactions to stay motivated. Other studies show that social support leads to increased physical activity and decrease reliance on healthcare services (Allam et al., 2015; Mamede et al., 2021). Much of the previous health gamification literature has explored the nature of social networking and social influence within gamified technologies, and social orientation will be explored further, from the perspective of how it relates to gamification design strategy.

2.3.2 PERSONALITY TRAITS IN HEALTH GAMIFICATION RESEARCH

Two of the gamified health intervention studies previously identified examine the aspect of *personality*: Orji et al. (2014) have adopted the *BrainHex* model of gamer types (Bateman & Nacke, 2010) as the theoretical basis for categorising players into their dominant gamer type; and Meixner et al. (2020) developed their own validated scale to measure personality and drivers of health behaviour change: stimulation needs, security needs, information acquisition, and information processing. The premise of both studies was that understanding the underlying personality traits of users leads to more effective design of health behaviour change interventions. Orji et al. (2014) investigated the relationship between player typography and persuasive strategy preference in a non-interactive, gamified prototype, and found that tailoring strategies to user types is an effective intervention design strategy. Conversely, Meixner et al. (2020) found that personality type does not predict application usage, and that user-centric design strategies are more effective. In Meixner et al. (2020), user-centric design preferences focused on features such as suggestions for activities, tracking, and gamification elements including rewards, feedback, progress and levels.

One of the challenges of personality profiling for health behaviour change interventions is that personality tests often do not consider factors such as the cultural background of respondents. Additionally, their application may be limited in the case of Indigenous people, whose belief systems are impacted by social norms and the perceived beliefs of referents. As the current research is exploring gamification from an Indigenous perspective, personality profiling participants may be less important than understanding the unique aspects of a Māori context.

2.3.3 HEALTH METRICS IN HEALTH GAMIFICATION RESEARCH

Health metrics is a broad category of observable characteristics such as age, gender, body mass index and physical activity levels identified in previous health gamification literature. The aim of Koivisto and Hamari (2014) is to determine whether age, gender and time using the service can predict the social, hedonic and utilitarian benefits of gamified exercise application. They found that the perceived benefits of gamified exercise software reduced over time; a finding that is consistent with the extant literature on digital gaming and may not be related to either gender or age. Ease-of-use is negatively influenced by both age and gender, as older women experience less ease-of-use and lower perceived usefulness of the technology (Koivisto & Hamari, 2014).

Fitbit fitness trackers and *Twitter* posts were evaluated for effectiveness in a gamified mHealth intervention feasibility pilot by Chung et al. (2017). They used body mass index (BMI) to categorise participants into groups of either healthy-weight (BMI<24.99), and overweight (BMI>25) individuals, and compared the differences over time of changes in physical activity levels. The authors stated that the overweight participants experienced decreased BMI, although this was not a primary outcome for the study.

Patel et al. (2019) investigated whether the use of a competitive or cooperative design would be more effective in increasing the physical activity levels of individuals with BMI>25. They grouped overweight people into one of three clusters: competition, cooperation, and control, and found that competition was more effective than cooperation, and that both strategies were more effective than the non-gamified intervention (Patel et al., 2019). One limitation of Patel et al. (2019) is that no data was captured about inter-participant interactions, and therefore the authors stated they cannot explain or evaluate the participant's experiences, beliefs or attitude toward the gamification element in this study. In a follow-up study, Lienert and Patel (2020) examined which phenotypes can predict weight loss. Participants were recruited in pairs, and one team member had to be BMI>30. Each pairing was randomised into one of three intervention

arms: control, gamification, and, gamification plus primary care physician information sharing. Lienert and Patel (2020) used latent class analysis to determine phenotypes based on underlying baseline characteristics and categorise participant pairs into *classes* that describe the nature of the relationship between the pairs: married teams, kin teams, and distant teams. These authors found that *married* teams lost more weight across all three arms of the trial and stated this was likely due to close social connection, which was a proxy for support. Furthermore, Lienert and Patel (2020) also found that patient phenotypes, which comprise multiple factors including: age, education, BMI, relationship with team member, and frequency of seeing the team member, are predictors of response to a weight-loss application. There appears to be a positive relationship between frequency of seeing the teammate and weight loss in the gamified intervention, this suggests that a high degree of social connection is important in health behaviour change adherence. However, some of the limitations of Lienert and Patel (2020) are the small sample size, and an over-representation of females in the study. It could also be argued that the phenotype classes were applied to the data somewhat subjectively, and therefore the finding may not be inferred for the whole population.

2.3.4 PERSUASIVE TECHNOLOGIES IN HEALTH GAMIFICATION

Another category of gamification studies evident in the extant literature is the exploration of strategy-driven persuasive technologies. Persuasive technologies are software applications that have been strategically designed to make the applications more engaging for users. Orji et al. (2014) investigated the effect of user typography to predict a user's receptiveness to various persuasive strategies, and in doing so identified ten persuasive strategies that may be effective in gamification design. Persuasive strategy is a dimension of health gamification where little previous research has been conducted, yet it is potentially an important aspect (Orji et al., 2014). Persuasive technologies and strategies will be discussed in *Section 2.6: Persuasive Strategies in Technology*, following discussions on the behavioural change and motivation theoretical frameworks that underpin these twelve studies.

This subsection has explored several dimensions of gamification that have been investigated in previous health behaviour change research. Studies in *Section 2.3.1: Social Dimensions in Health Gamification Research* showed that social interaction is an important aspect of health behaviour change interventions, and it may have a positive impact on attitude and continued use intentions, and it may be a contributing factor to increased motivation. *Section 2.3.2: Personality Traits in Health Gamification Research* discussed that

player typographies and personality traits have been investigated to determine whether user types could predict intervention effectiveness. Similarly, *Section 2.3.2: Health Metrics in Health Gamification Research* briefly described the aspect of health metrics which included demographics, body mass index, and physical activity levels as predictors of gamification effectiveness. *Section 2.3.4: Persuasive Technologies in Health Gamification Research* has briefly introduced persuasive technologies and strategies as an attribute that may be important in gamification design. The next two sections discuss will discuss the health behaviour change theories adopted in each of the previously mentioned studies, followed by a discussion of motivational theories in gamification research in *Section 2.5*.

2.4 HEALTH BEHAVIOUR CHANGE THEORIES IN GAMIFICATION

This subsection discusses the health behaviour change theories that were identified in the health gamification research previously presented. To discuss how gamification can support health behaviour change, it is necessary to present foundational behaviour change theories in these areas. While there are several appropriate theories that can be used to discuss behaviour change, there are three theories that were identified from the gamification in health literature summarised on Table 2.5, that are also commonly cited in educational and business gamification literature:

1. Social Cognitive Theory (Bandura, 1989)
2. Theories of Reasoned Action (Fishbein & Ajzen, 1975) and Planned Behaviour (Ajzen, 1991)
3. Technology Acceptance Model (Davis et al., 1989)

Each of these theories will be briefly discussed in this section, with the *Reasoned Action Approach* (Fishbein & Ajzen, 2011) being used as the theoretical framework for this study.

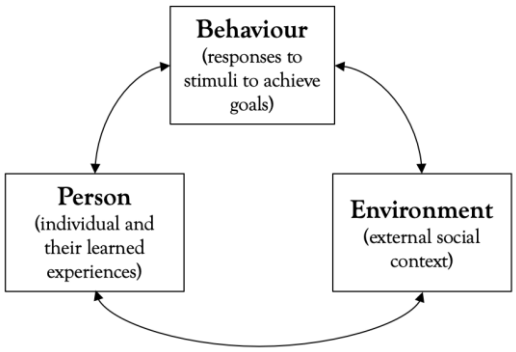
2.4.1 SOCIAL COGNITIVE THEORY

Early behavioural theorists such as Skinner (1938) argued that learning is a direct result of conditioning, reinforcement, and punishment. Yet, one of the most frequently applied theories of health behaviour (Baranowski et al., 2002), *Social Cognitive Theory* (SCT) (Bandura, 1989), emerged from early work on *Social Learning Theory* in which Bandura (1971) stated that human behaviours are learned by observing both a modelled behaviour and the consequences of the performance of that behaviour within a social environment. Based on the internalisation of these observations, individuals may choose to replicate the behaviour of others (Bandura, 1971). This social learning process shortcuts experimental learning by trial and error (Schwarzer & Luszczynska, 2005).

Reciprocal determinism is a central tenet of SCT (LaMorte, 2019) which stated that behaviour can be explained in terms of a triadic model showing the reciprocal and dynamic interactions between the individual, their environment, and the behaviour (Baranowski et al., 2002); see Figure 2.5. Although commonly cited *as* the SCT model, reciprocal determinism is a sub-theory of SCT which stated that an individual's behaviour both influences and is influenced by the individual's personal factors and their social environment (Bandura, 1989). Triadic reciprocal causation refers to the mutual interactions between three factors: *Person factors* such as cognitive, affective, and biological events; *environmental factors* such as the social context; and actual *behaviour*. An individual makes a causal contribution to their own motivation as person, environment and behavioural beliefs interreact and operate as determinants of behaviour (Bandura, 2004). Thus, in SCT, there is a direct correlation between an individual's perceived self-efficacy and behavioural outcomes (Bandura, 1989). *Self-efficacy* is a key construct of SCT that refers to an individual's confidence in their ability to successfully perform a specific behaviour, and reflects how much effort an individual will exert to overcome obstacles (Bandura, 1989).

Figure 2.5

Triadic reciprocal causation model



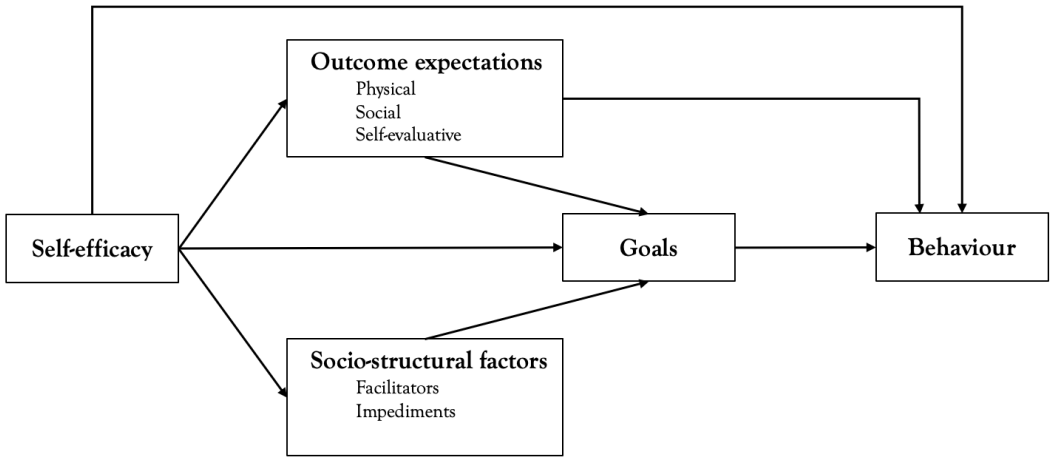
Reconceptualised from (Bandura, 1989)

Bandura (2004) also stated that self-efficacy is only one determinant of health behaviour change. Other factors include *knowledge* of health risks and perceived benefits relating to the target behaviour; perceived *outcome expectations* about the expected costs and benefits of performing the behaviour; the health *goals* that individuals set for themselves and the strategies for actualising them; and the *perceived facilitators* and *impediments* to making health behaviour changes. Figure 2.6 illustrates that self-efficacy affects health-behaviours both directly, and indirectly by impacting goals, outcome expectations, and the

individual's perceptions of socio-structural facilitators and impediments to health behaviour change (Bandura, 2004).

Figure 2.6

Structural paths of influence



Redrawn from: Bandura (2004)

Structural paths of influence illustrate that an individual is more likely to undertake a positive health-related behaviour change if they have a belief that the benefits of doing so will outweigh the consequences of not undertaking the change, and, if the individual has a sense of self-confidence with regard to performing the behaviour despite the challenges that make a positive behaviour change difficult (Fishbein & Yzer, 2003).

One implication of SCT within gamification is that learning can take place within a gamified application, and users of such an application can learn "habitual models of behaviour from observational experience" (Knobloch et al., 2005, p. 124). Ultimately, SCT may support the notion that a person who uses a fitness-related gamified application might start to construct ideas about healthy exercising habits through continual usage (Terlutter & Capella, 2013), particularly when the social environment provides models of behaviours by incorporating structured behavioural goals and social support systems within a behaviour change intervention (Bul et al., 2015). In health-gamification studies such as Mamede et al. (2021) and White et al. (2019), SCT informs the research design, and its implementation suggests that SCT's main advantage is in constructing behaviour change interventions that support the user's acquisition of behaviour specific knowledge, and confidence thereof.

Behaviour change theories commonly focus on behaviour initialisation, whereas SCT considers both initiation and continued behavioural action goals (Baranowski et al., 2002).

In health behaviour change, this distinction is important as behavioural maintenance is a predictor of positive long-term health behaviour change outcomes. Behavioural change can occur when people have a personal sense of control and a belief they can be successful (Schwarzer & Luszczynska, 2005). In one health-gamification study, Mamede et al. (2021) stated that self-efficacy can be leveraged by influencing the physical and social environment to promote a desired behaviour.

2.4.1.1 LIMITATIONS OF SOCIAL COGNITIVE THEORY

Social Cognitive Theory has been criticised for a lack of unified principle or structure, and some researchers argue that the theory is too broad and that one theory cannot completely explain behaviour (Beauchamp et al., 2019). However, it could also be argued that many implementations of SCT focus on the concept of self-efficacy rather than the entirety of the theory (Beauchamp et al., 2019), which indicates a misunderstanding of the theory as a whole. SCT studies that claim to measure self-efficacy often inadvertently assess *motivation* to perform a target behaviour rather than perceived confidence in an individual's ability to actually perform the behaviour (Beauchamp et al., 2019; Kirsch, 1995). It is important to note that many health behaviour theories now include an element of self-efficacy, including the *Theory of Planned Behaviour* (Beauchamp et al., 2019), which will be discussed in *Section 2.4.2*.

Although widely cited in health behaviour change research, SCT is not widely adopted in either gamification research, or information systems research. It is interesting to note that instances of SCT in information systems research frequently integrate constructs from the *Technology Acceptance Model* such as Perceived Usefulness, and Perceived Ease of Use (Carillo, 2010). Combining SCT and TAM suggests that SCT alone may be less useful in explaining user-behaviour in a technology context (Carillo, 2010). The Technology Acceptance Model (TAM) will be discussed in *Section 2.4.3* because it is an adaptation of the theories presented in *Section 2.4.2* and it has application within technology research.

2.4.2 THEORIES OF REASONED ACTION AND PLANNED BEHAVIOUR

The theories of Reasoned Action and Planned Behaviour suggest that behavioural intention is the antecedent to *actual* behaviour, and that behavioural intention can be predicted by attitudes and subjective norms. This section will first explain the *Theory of Reasoned Action* (TRA) (Fishbein & Ajzen, 1975), then explain how that theory evolved into the *Theory of Planned Behaviour* (TPB) (Ajzen, 1991). As these theories are so closely related, they are

presented together. Both TRA and TPB evolved into the *Reasoned Action Approach*, which will be discussed in *Section 2.4.5* and adapted for the current research.

Initially developed as a framework for explaining social influence in behavioural psychology, TRA is frequently employed within health behaviour research (Cugelman et al., 2011; Sheppard et al., 1988) and is primarily concerned with *behavioural intentions,* it states that an individual is assumed to form a behavioural intention which influences their subsequent actual behaviour. According to Fishbein and Ajzen (1975) there are two key variables that determine behavioural intentions: *attitudes* and *subjective norms*.

2.4.2.1 ATTITUDE

Fishbein and Ajzen (1975) theorise that attitudes are the learned predispositions people have toward behavioural intentions, rather than towards the actual behaviour itself. Attitudes are informed by beliefs, which represent the information an individual has about an object and its associated attributes (Fishbein & Ajzen, 1975). An example of this relationship between behaviour and attributes is *running* (behaviour) and its association with *increasing fitness* (attribute). Fishbein and Ajzen (1975) go on to state that *beliefs* are evaluated by the strength of the association between object and attribute. To re-use the previous running example, the beliefs an individual has about running can be measured by determining how strongly the individual associates running with increased fitness, and whether that individual has a favourable, or unfavourable attitude towards increased fitness. *Behavioural intention* is the subjective probability that an individual will perform the behaviour – running, in this example.

2.4.2.2 SUBJECTIVE NORMS

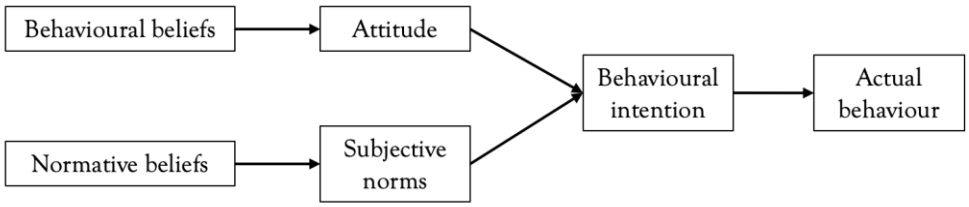
The second variable used to predict behavioural intentions is *subjective norms* (Fishbein & Ajzen, 1975), which deal with the influences of the individual's social environment on a specific behaviour. Fishbein and Ajzen (1975) stated that the "subjective norm is the person's perception that most people who are important to him think he should or should not perform the behavior in question" (p. 302). Importantly, subjective norms comprise of two significant *normative beliefs*: the perceived expectations of the referent group (such as friends and whānau), and the individual's motivation to comply with those perceived expectations. The strength of normative beliefs are multiplied by the individual's motivation to comply with the referent's perceived expectations (Ajzen, 2012).

To summarise, Fishbein and Ajzen (1975) theorise that attitude and subjective norms are determinants of behavioural intention, and the theory of reasoned action explains the

relationship between these variables (see Figure 2.7). Attitudes are informed by an individual's beliefs about the object and beliefs about its attributes; and subjective norms result from an individual's normative beliefs and motivation to comply with a behaviour. The concept of *motivation* in behaviour change is important, and Doswell et al. (2011) stated that understanding an individual's motivation is a primary purpose of TRA. Motivation theory is introduced and discussed in *Section 2.5: Motivation Theories in Gamification Research.*

Figure 2.7

Theory of Reasoned Action



Redrawn from: Fishbein and Ajzen (1975)

Although TRA has been widely used in health behaviour research, the theory has certain limitations and has undergone multiple modifications since its origins. The theory is only concerned with behaviours that are under an individual's volitional control. It specifically excludes actions which are under the control, or partial control of factors external to an individual (Sheppard et al., 1988). For these reasons, TRA was later enhanced with the inclusion of *perceived behavioural control* as a core component of behavioural intention, and the theory was re-named the *Theory of Planned Behaviour* (TPB) (Ajzen, 1991).

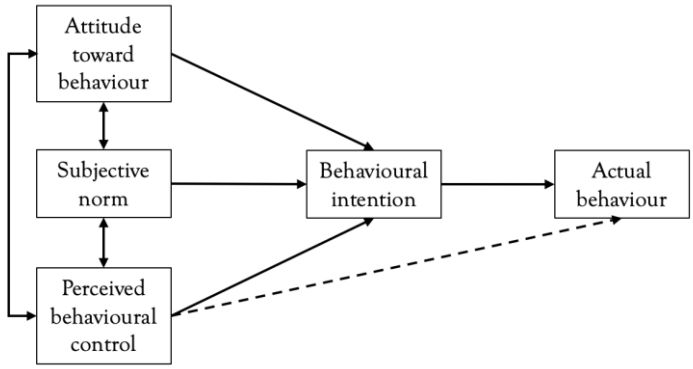
The Theory of Planned Behaviour is essentially an extension of TRA "designed to predict and explain human behavior in specific contexts" (Ajzen, 1991, p. 181). As in TRA, the TPB holds that an individual's intention to perform a specific behaviour is a predictor of the likelihood of them performing the *actual* behaviour. TPB accounts for a limitation in TRA by acknowledging that an individual's volitional control is an antecedent of behavioural intent; that is, "if the person can decide at will to perform or not perform the behavior" (Ajzen, 1991, p. 182). It is the addition of *perceived behavioural control* as a variable that differentiates TRA and TPB (Ajzen, 1991).

2.4.2.3 PERCEIVED BEHAVIOURAL CONTROL

Perceived behavioural control refers to an individual's perception of the ease or difficulty of performing a specific target behaviour, and that the strength of this perception is an antecedent to behavioural intent. For example, an individual who perceives that a behaviour will be easy for them to perform will more likely persevere with the behaviour than someone who doubts their own abilities (Ajzen, 1991). In that way, perceived behavioural control, together with behavioural intentions, can be used to predict the likelihood of actual behaviour (see Figure 2.8).

Figure 2.8

Theory of Planned Behaviour



Redrawn from Ajzen (1991)

Ajzen (2020) argues that that there is no conceptual difference between perceived behavioural control and Bandura's concept of self-efficacy as both refer to an individual's belief that they can perform a target behaviour. He further stated that the differences are in the assessment of the constructs: self-efficacy measure the degree to which an individual believes they can overcome obstacles to performing a behaviour; and, perceived behavioural control measures the individual's perception in their ability to perform the behaviour, and the extent to which performing the behaviour is under their control. Thereby, perceived behavioural control excludes barriers outside the individual's control.

As previously discussed, SCT stated that self-efficacy is a determinant of behaviour and that all behaviour is learned through observation of modelled behaviour within a social context and is influenced by previous learned experiences (Bandura, 1989). Whereas TRA and TPB illustrate that behavioural intentions precede actual behaviour and that attitudes and subjective norms reliably predict behavioural intentions (Ajzen, 1991; Davis, 1989; Fishbein & Ajzen, 1975).

Within the context of gamification, TRA and TPB provide a basis to predict and explain an individual's Intention to Use a gamified application, by measuring their attitudes and perceptions towards *perceived usefulness* and *perceived ease-of-use* as antecedents for behavioural intentions (Hamari & Koivisto, 2015b). Koivisto and Hamari (2014) used TPB to inform one aspect of their social influence construct stating that an individual's use of the health-application *Fitocracy* would be influenced by their perceptions of other people's approval for using the application. Koivisto and Hamari (2014) also found that social influence is weakened over time, suggesting that as users gain experience and confidence with an application, the effects of peer opinion are reduced.

2.4.2.4 LIMITATIONS OF THE THEORIES OF REASONED ACTION AND PLANNED BEHAVIOUR

There is criticism of both the Theory of Reasoned Action (TRA), and the Theory of Planned Behaviour (TPB), because of their focus on rational reasoning which excludes unconscious behavioural influences (Sheeran et al., 2013). Some researchers consider that TRA does not recognise the role of human volition and control on behaviour, however this was mitigated with the extension of TPB. Criticism of TRA and TPB is partially addressed by the *Reasoned Action Approach* (RAA), which is an evolution of TRA and TPB; RAA is proposed as the framework for the current research in *Section 2.4.5.1*.

Some researchers have stated that the TPB name implies that humans *plan* their behaviour, and that behaviour is a result of making rational choices, when in reality, people rarely make completely rational choices or plan their behaviour (Chatterton, 2016). Although behavioural intention is an antecedent of actual behaviour, actual behaviour does not automatically follow from behavioural intention, as people may have every intention to make a behavioural change and still fail to take action (Beauchamp et al., 2019). The TRA and TPB models predict behaviour from a one-off measure of behavioural intention; yet changes over time and external influences are not taken into account (Doulati, 2016; LaMorte, 2019) This is partially addressed in the RAA model, which does consider distal variables including social context. (Ajzen, 1991; Alkhwaldi & Kamala, 2017).

In both TRA and TPB, demographic constructs and behaviour planning or goal-setting is ignored (Alkhwaldi & Kamala, 2017). These may be important variables to consider especially when explaining health behaviour change initialisation. Perceived behavioural control is proposed as a single variable to explain all non-controlled factors relating to an individual's behaviour (Taylor & Todd, 1995). These issues are also partially

addressed in RAA, as distal variables are shown to indirectly impact behavioural intention, and goal-setting is considered an important aspect of forming behavioural intention (Abraham & Sheeran, 2003). There has been criticism that since TRA was not specifically designed for use in information systems research, it may not include all variables relevant in information systems (Ajzen, 1991; Baraghani, 2008). To mitigate this limitation, Davis et al. (1989) extended TRA into the *Technology Acceptance Model*, which will be presented in the next subsection.

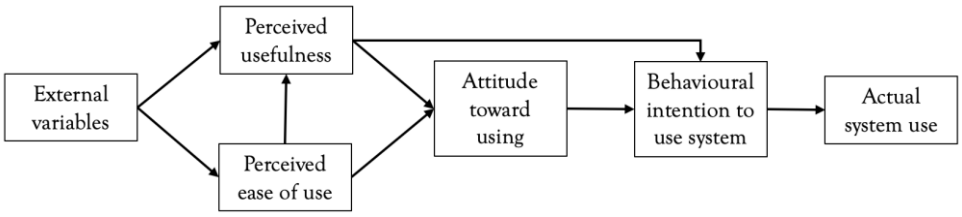
2.4.3 TECHNOLOGY ACCEPTANCE MODEL

Another theory found in information systems research that also has applications in health-gamification is the *Technology Acceptance Model* (TAM) from Davis et al. (1989). Essentially, TAM is an extension of Ajzen and Fishbein's *Theory of Reasoned Action* that stated the TRA's measure of attitude is influenced by *user acceptance*, and *actual usage* of technologies. TAM measures the point where individuals are using the technology (actual behaviour) rather than simply intending to use the technology (behavioural intention). This differs from TRA in that it relates specifically to technology behaviours.

Behavioural intention (BI) is still an important construct in TAM; much like the TRA, Davis et al. (1989) contend that BI is influenced by an *attitude toward using* the target technology. However, they also stated that attitude is jointly influenced by *Perceived Usefulness* (PU), and *Perceived Ease-of-Use* (PEOU). Davis et al. (1989) define PU as "the prospective user's subjective probability that using a specific application system will increase his or her job performance within an organizational context" (p. 985). This is widely interpreted as meaning whether an individual perceives that a technology will be useful to them within their specific context. The second construct, PEOU, is defined by Davis et al. (1989, p. 985) as "the degree to which the prospective use expects the target system to be free of effort" (p. 985). The TAM is illustrated in Figure 2.9.

Figure 2.9

Technology Acceptance Model



Redrawn from Davis et al. (1989)

Unlike the Theory of Reasoned Action, TAM does not support subjective norms as a determinant of behavioural intention. Davis et al. (1989) consider that the subjective norm scale "is particularly weak from a psychometric standpoint" (p, 998), and that some software applications may be less influenced by social factors than others, so therefore subjective norms are not generalisable across information systems research. The value of TAM to the development of a gamified health intervention is significant as it illustrates the importance of an application's perceived usefulness and its' ease-of-use in the design process. Both these factors are expected to have a significant impact on an individual's attitude towards an application, and therefore impact the user's behavioural intention. Rajani et al. (2021) found that there may be an association between the perceived usefulness of gamified health applications and increased motivation to use a behaviour-change intervention. This finding highlights the value of further exploring the effects of gamification.

2.4.3.1 LIMITATIONS OF TECHNOLOGY ACCEPTANCE MODEL

Even though the Technology Acceptance Model (TAM) is widely cited in Information Systems (IS) research, it has also been frequently criticised. Its origins are in business research; TAM was developed to explain the drivers of technology acceptance in business to understand why employees were not engaging with IS technologies (Davis et al., 1989; Malatji et al., 2020). Its role in non-business contexts is not always clearly understood. Malatji et al. (2020) stated that an employee's behavioural intentions may be influenced by colleagues making positive comments about the technology which, in turn, may influence users' perceptions of usefulness and effect their attitude toward the technology; or the technology's adoption may be mandated by management. In a health context, social influence between users is less clearly understood, and represents a potential gap in current research.

Some literature considers that TAM is a variable of TRA rather than a standalone theory to explain behavioural intention (Bashange, 2015) as it explains technology acceptance by declaring that perceived usefulness (PU) and perceived ease-of-use (PEOU) positively impact attitude, and attitude is an antecedent of behavioural intention. Further studies suggest that TAM ignores the other antecedents of behaviour change by only measuring a small part of actual usage prediction without considering external variables such as social influence, motivation to comply, or behaviour initiation (Malatji et al., 2020). Understanding how PU and PEOU predict behavioural intention, alongside social norms and perceived behavioural control may explain the predictors of the efficacy of health

behaviour change interventions. These limitations may be addressed by including the constructs of TAM as variables predicting behavioural intention in the RAA. The next subsection presents a comparison between each of the models previously presented and then introduces the *Reasoned Action Approach* as a theoretical framework for this research.

2.4.4 COMPARISON OF BEHAVIOUR CHANGE THEORIES

Sections 2.4.1 to 2.4.3 have presented four behaviour change theories that were identified from the literature presented in *Section 2.3: Gamification in Health*: Social Cognitive Theory (Bandura, 1989); the Theory of Reasoned Action (Fishbein & Ajzen, 1975); the Theory of Planned Behaviour (Ajzen, 1991); and the Technology Acceptance Model (Davis et al., 1989). These four theories are also commonly cited in gamification literature in the educational and business domains. Behaviour change theories are useful in gamification research to help explain the factors that directly influence target behaviours, this is especially important in health and fitness interventions because their purpose is to elicit behaviour change.

Social Cognitive Theory is perhaps the least relevant theory to the current research project because of its lack of application in gamification literature across multiple domains. The SCT framework in information systems literature sometimes includes elements from TAM (Carillo, 2010). This signals that SCT may have limited application in technology research, as potentially its' ability to predict behavioural outcomes manifests as the belief that an individual perceives they would be able to use the technology. A factor that is similar to perceived ease-of-use, and perceived usefulness, variables from the TAM model. *Section 2.4.1: Social Cognitive Theory* stated that one of the main constructs from SCT is self-efficacy, and that this is often misconstrued as motivation (Beauchamp et al., 2019). Self-efficacy is an important factor in health behaviour change, as it relates to an individual's beliefs that they can perform a specific behaviour, and in this respect, the construct of self-efficacy is practically identical to the concept of perceived behavioural control in TRA (Ajzen, 2020).

The Theory of Reasoned Action (TRA) and its extensions TPB and TAM, have been used previously in IS research, and specifically in gamification research (see Koivisto and Hamari (2014); Hamari and Koivisto (2015b); and, Rajani et al. (2021), therefore, their application is more clearly understood. However, these theories do not specifically explore external factors such as the impact of culture and social structure on health behaviour change applications. As this study is exploring the use of gamification in a Māori health context, the impact of culture and society will be important. This leads to a

suggestion that a more integrative approach might be appropriate for this research. Distal variables such as social-influence, demographics, culture, and life-experiences are addressed in the *Reasoned Action Approach*, which is an evolution of TRA and TPB.

2.4.5 REASONED ACTION APPROACH

The *Reasoned Action Approach* (RAA), as illustrated in Figure 2.10, is an umbrella term that encompasses theories such as Theory of Reasoned Action and the Theory of Planned Behaviour. It is an integrative model of behaviour change that recognises an individual's attitudes, perceived norms and self-efficacy are predictors of behavioural intention. Furthermore, it recognises that these factors are influenced by an individual's beliefs about likely outcomes of performing the behaviour; their beliefs about the perceived expectations that people they consider to be important have toward the individual's behaviour; the individual's motivation to comply with the behavioural expectations of referents; and the individual's beliefs regarding their own ability to undertake the behaviour. The RAA model suggests that distal variables have an indirect impact on behavioural intentions and that these variables are mediated by the proximal variables specified on the model (Yzer et al., 2004). Additionally, Fishbein and Yzer (2003) stated that background factors may correlate with behavioural intention or actual behaviour. However, such correlation indicates the background factor is also related to one or more of the proximal variables.

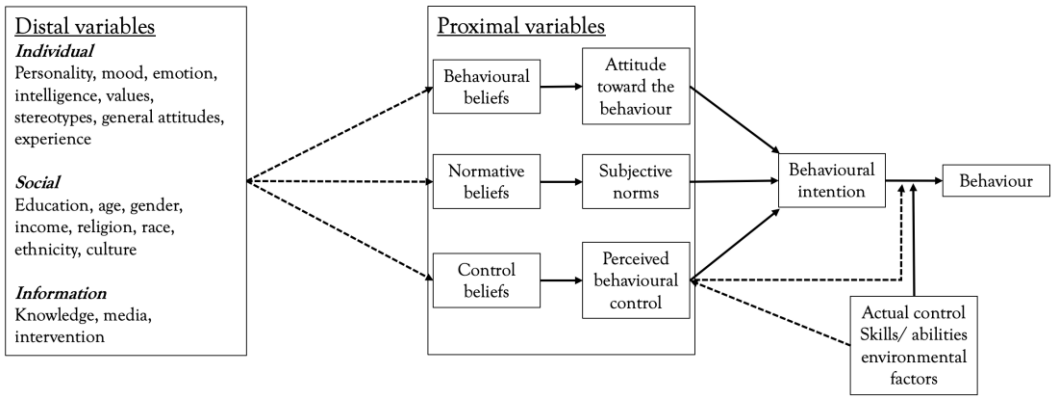
The relative importance of the three determinant constructs of behavioural intention may vary between different populations and different behaviours:

> Intention to perform one behaviour may be primarily determined by attitude toward the behaviour, while another behavioural intention may be determined largely by normative influence. Similarly, intention to perform a particular behaviour may be primarily under attitudinal influence in one population, while more influenced by normative influence or personal agency in another population (Montano & Kasprzyk, 2015, p. 79).

Therefore, to design effective interventions to influence behaviour, it is important to identify the degree to which the intention to perform a desired behaviour within a specific population is influenced by attitude, subjective norms, and perceived behavioural control. Therefore, it is of critical importance to understand how background factors impact behavioural intention, and which factors are important.

Figure 2.10

Reasoned Action Approach



Redrawn from: Ajzen et al. (2018)

An RAA approach allows the researcher to explore the salient beliefs of a population toward a specific target behaviour. It is a useful structure for designing health-behaviour change interventions as it serves as a blueprint for both health-behaviour change communication, and for understanding where individuals are in the health-behaviour change decision-making process. For example, Fishbein and Yzer (2003) stated that if an individual has formed a health-behaviour change intention but are not acting on it, then an effective intervention will target skills building or removing barriers. Conversely, if an individual has not formed a strong health-behaviour change intention, the model suggests that an intervention might target attitude, perceived norms, or self-efficacy beliefs within the target population.

2.4.5.1 JUSTIFICATION FOR CHOOSING REASONED ACTION APPROACH

There is precedented use of the RAA model in health gamification literature, (see Hamari and Koivisto (2019) as an example); it makes an important contribution to gamification research as it shows that background factors such as intervention design have an indirect impact on behavioural intention, and also that they are mediated by attitude, social norms, and perceived behavioural control (Yzer et al., 2004). The role of social and cultural context is not well understood in broader gamification research, and less so within Indigenous and minority populations. Understanding the social factors that influence behaviour change for Māori is critical in order to design culturally respectful and effective healthy lifestyle interventions.

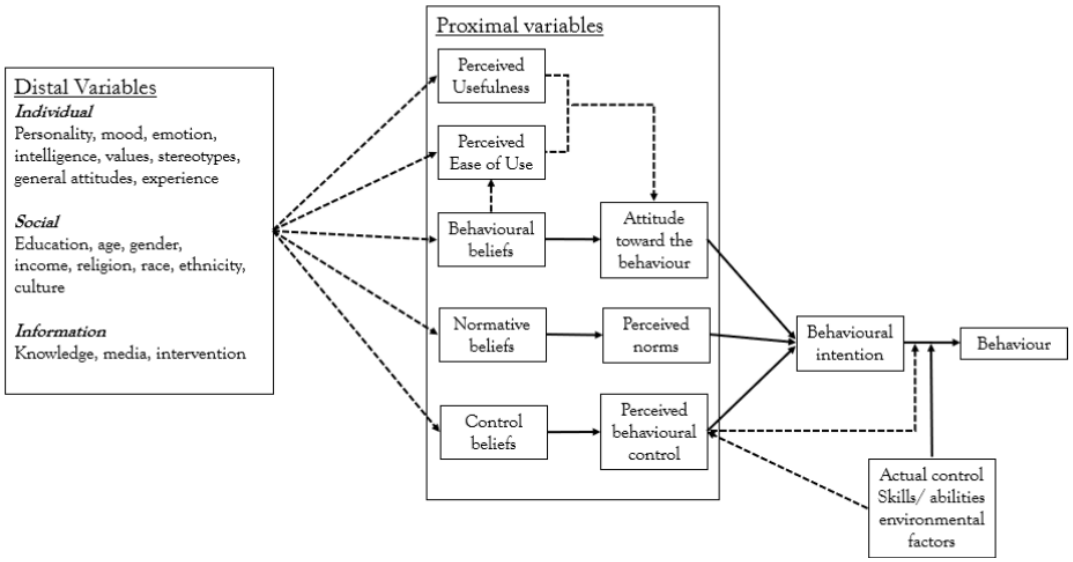
The RAA model allows the researcher to explore the relationships between variables in a real-world context, and this aligns with a kaupapa Māori approach in that it can lead

to culturally-tailored interventions. The RAA illustrates that an individual's beliefs about their position in society, in relation to their perceptions about the beliefs of referents ultimately impacts actual behaviour, and these factors may be important design considerations for supporting healthy lifestyle behaviours. Therefore, the RAA model is both useful and culturally appropriate in the current research. However, RAA was not specifically developed for use in information systems research, and the impact of an intervention's design or its impact on attitude is not specifically measured.

It could be argued that the Technology Acceptance Model (TAM) may be a better fit for IS research, as it is directly applicable in technology research and specifically measures an individual's perceptions about the technology's usefulness and ease of use. Both of which Davis et al. (1989) argues are positively correlated with a user's attitude toward the technology, and that a positive attitude is a predictor of behavioural intention and ultimately actual usage of the technology. However, TAM is only concerned with the antecedents of *attitude*, and ignores the contributing effects of social norms and perceived behavioural control on behavioural intention. Therefore, the RAA model has been adapted from Davis et al. (1989) and Ajzen et al. (2018) for this research to also include the variables Perceived Usefulness and Perceived Ease of Use as predictors of behavioural intention. The RAA model adopted for the current research is illustrated in Figure 2.11.

Figure 2.11

Reasoned Action Approach (Technology)



Reconceptualised from Davis et al. (1989) and Ajzen et al. (2018)

Section 2.4: Health Behaviour Change Theories in Gamification has presented four behaviour change theories that were identified from previous gamified health-behaviour change literature. It has specifically discussed Social Cognitive Theory, and then the interrelationships between Theory of Reasoned Action, Theory of Planned Behaviour, and the Technology Acceptance Model. Each of these theories falls under the Reasoned Action Approach umbrella and have been used by researchers to explore the salient beliefs of a population toward a specific target behaviour. The RAA approach is considered the most appropriate for the current research. However, it has also been argued that aspects of the TAM are also appropriate as it is an RAA approach, specifically developed for technology. Therefore, this section also proposed a Reasoned Action Approach (Technology) as the framework for this study because as well as considering distal variables, the RAA (Technology) also considers Perceived Usefulness and Perceived Ease of Use as predictors of behavioural intention.

As previously discussed in *Section 2.3: Gamification in Health,* behaviour change technologies are frequently operationalised through a range of persuasive strategies. Fogg (2003) stated that persuasive strategies stem from behaviour-change theories such as a Reasoned Action Approach (Ajzen, 2012; Fishbein, 2008) and from motivational theory. As these topics are closely related, *Section 2.5* presents literature relating to motivational theory in health gamification. This is followed by *Section 2.6* which presents literature relating to persuasive strategies and technologies, and *Section 2.7* which links persuasive strategies back to behaviour change and motivation theory.

2.5 MOTIVATION THEORIES IN GAMIFICATION RESEARCH

The previous section has dealt with behaviour change theories specifically adopted in gamified health-behaviour change intervention research, In humans, motivation is the subjective sense of wanting some change in self and, or environment, and includes the predisposition to behave in ways that will facilitate such a change (Baumeister, 2016). Ryan and Deci (1999) define motivation as the "means to be moved to do something", the authors further stated that "a person who feels no impetus or inspiration to act is thus characterised as unmotivated, whereas someone who is energised or activated toward an end is considered motivated" (p. 54). By understanding motivation, designers of health behaviour change interventions can design better applications (Cugelman et al., 2011).

One of the criticisms of behaviour change theory is its inability to explain motivation, or higher-order behaviour triggers that initiate behaviour change (Pinder et al., 2018).

However, this criticism is contradicted in Doswell et al. (2011) who stated that understanding an individual's motivation to perform a voluntary behaviour, is a primary purpose of the Theory of Reasoned Action. A critical element of effective gamification design is identifying what motivates users to engage with an application (Nacke & Deterding, 2017). In the health-gamification studies presented in *Section 2.3: Previous Health Gamification Research*, Hamari et al. (2018) use Self-Determination Theory (Ryan & Deci, 2000) to explain psychological drivers affecting gamification in health interventions. Therefore, Self-Determination Theory will be discussed in this section as it relates closely to behaviour-change theory. This section draws on a broader range of gamification and health literature, not only that from the previously identified gamified health behaviour change literature.

2.5.1 SELF-DETERMINATION THEORY

Self-Determination Theory (SDT) is a well-established theory that explains human motivation; it relates to the motivation behind human decision-making when those decisions are made without external influence or influence (Deci & Ryan, 1985). The principles of SDT are applied in many domains including education, health, and business, and furthermore, the theory is commonly leveraged in gamification studies. Examples of SDT in a broader gamification context include: business gamification motivating employees to participate in customer service marketing initiative (Cadwallader et al., 2010); an exercise focussed smartphone application (Hamari et al., 2018); and a machine learning algorithm to personalise the gamified experience for users of a collaborative-learning environment (Knutas et al., 2019). Each of these studies is seeking to explain the antecedents of motivation for a target behaviour within a gamified context.

Studies of motivation often consider motivation as a single unified concept: an impetus that people have in varying amounts relative to a specific action (Cadwallader et al., 2010). The more motivation an individual has, the higher their aspiration and the effort they will exert when compared to individuals with lower motivation (Bandura, 1996; Cadwallader et al., 2010). However, in contrast, SDT distinguishes between three types of motivation: amotivation, extrinsic motivation, and intrinsic motivation, and stated that the *type* of motivation is more important than the *amount* in predicting behavioural outcomes (Ryan & Deci, 1999).

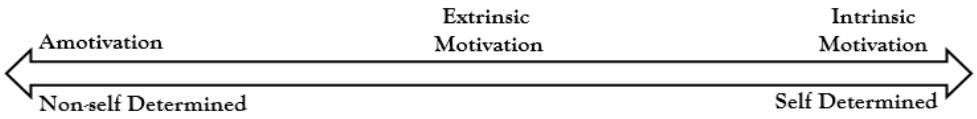
Markland and Tobin (2004) define *amotivation* as "lacking any intention to engage in a behaviour" (p. 191), it manifests as passiveness and occurs when an individual is neither intrinsically nor extrinsically motivated. For example, when the individual does not

perceive associations between the outcomes and their own actions (Vallerand et al., 1992). Individuals in an amotivated state will fail to value the behaviour or to evaluate whether they are capable of successfully engaging in it (Ryan & Deci, 2000). *Extrinsic motivation* refers to an individual's impetus to complete an activity because it leads to a distinct consequence, such as a reward, which is separate from the activity itself (Reeve, 2014), and *intrinsic* motivation refers to undertaking an activity because it is fundamentally interesting or pleasurable such as the desire to explore and learn (Reeve, 2014).

The term *self-determination* refers to an individual's freedom to choose to initiate and to self-regulate their own actions without being subjected to external influences (Deci & Ryan, 1985). It is possible to visualise the concept of motivation as a continuum from a non-self-determined state to a self-determined state (Cadwallader et al., 2010), this is shown in Figure 2.12. Self-determined behaviours tend to be intrinsically motivated, and done for the pure enjoyment, interest, or inherent satisfaction of the task itself, whereas non-self-determined behaviours are performed under compulsion because the task must be done. There is a lack of individual freedom and autonomy over the performance of the behaviour, and these behaviours are associated with amotivation (Deci & Ryan, 1985). Therefore, the more intrinsically motivated an individual is to complete an action, the more likely they will do so of their own free will. One sub-theory of SDT explains that humans are intrinsically motivated to undertake activities that satisfy three inherent psychological needs: *autonomy:* the experience of being the perceived origin or source of one's own behaviour; *competence:* a sense of efficacy when dealing with the social environment; and *relatedness:* the feeling of connection with others (Deterding, 2015; Ryan & Deci, 1999; Vallerand et al., 1992).

Figure 2.12

Motivation continuum



Reconceptualised from Ryan and Deci (1999) and Cadwallader et al. (2010)

Davis (1989) stated that intrinsic and extrinsic motivation are important factors of behavioural intention, and both Bandura (1989) and Ajzen (1991, 2020) stated that intention is a determinant of actual behaviour. Behavioural prediction theories discuss the concepts of self-efficacy (Bandura, 1989) and perceived behavioural control (Ajzen, 1991,

2020). Autonomy is a factor of voluntariness, and competence is related to self-efficacy (Cadwallader et al., 2010). Self-efficacy reflects how much effort an individual will exert, and effort, agency, and commitment are aspects of motivation (Koole et al., 2019), and motivation is a reflection of the individual's impetus or inspiration to exert effort toward a specific action (Ryan & Deci, 1999), or target behaviour. Self-determined behaviours and self-regulation relate to higher levels of persistence, and higher levels of persistence lead to positive behavioural outcomes (Cadwallader et al., 2010).

2.5.2 RELATING SELF-DETERMINATION TO GAMIFICATION

In gamification research, psychological experiences such as competence, autonomy, and relatedness are related to outcomes such as user enjoyment and engagement (Koivisto & Hamari, 2019). The more enjoyable or self-regulated a behaviour is, the more it is experienced as enjoyable, and the longer the individual will perform the behaviour without need for external reward (Hamari & Koivisto, 2015a). Gamification has to consider the motivation of the users (Knutas et al., 2019). This is an important consideration because gamification attempts to *change* motivation rather than influence attitude or behaviour directly (Hamari & Koivisto, 2013). Gamification may increase autonomy and competency through positive feedback in the form of points, badges, leaderboards, and text to leverage intrinsic and extrinsic motivation (Garett & Young, 2018).

Previous gamification studies found that the use of extrinsic rewards can support behaviour change outcomes, this may be particularly useful in the health context (Earle et al., 2018; Garett & Young, 2018; Hamari et al., 2018). According to Hamari et al. (2018), extrinsic rewards such as points and badges can be effective to reward outcome-focused users for achieving goals rather than making the behaviours themselves intrinsically motivating. Many health behaviour change interventions rely on extrinsic motivators such as financial compensation, yet Earle et al. (2018) suggests that intrinsic factors may be more effective as they are more impactful (Deterding et al., 2011) and sustainable long term and that paying participants is not generalisable at scale, particularly in the health sector (Earle et al., 2018). Furthermore, adding extrinsic motivators to a behaviour may have a detrimental effect on the intrinsic motivation a person already had for the target behaviour (Pink, 2011), Schell (2014) calls this the *gamification backlash*.

It has been stated previously that intrinsic motivators are more powerful than extrinsic motivators (Deci, 1975; Deci & Ryan, 1985; Drafke, 1998) and studies show that the application of extrinsic rewards may lead to a decrease of performance for tasks previously enjoyed by the participant (Deci, 1971; Paharia, 2013). This has important

implications for gamification design, as previously, many interventions add a layer of extrinsic rewards to existing behaviour change interventions. Table 2.6 illustrates the differences between extrinsic and intrinsic rewards. Cameron (2001) contends that there is no inherent negative property of rewards, and that rewards may be valuable when the user's interest in the activity is initially low. In particular, there were no negative effects when rewards were offered for accurately completing a task or performance standard (Cameron, 2001). This suggests that tangible rewards may be appropriate for goal or task completion and may motivate users to undertake an activity that has low initial appeal.

Table 2.6

Examples of extrinsic and intrinsic rewards

Extrinsic Rewards	Intrinsic rewards
Money	Recognition
Points	Achievements
Badges	Power
Prizes	Fun
Penalties	Mastery
Perks	Pride
Progress bars	
Trophies	

Adapted from: Dale (2014)

According to Deci (1975), the removal of extrinsic rewards may also have a demotivating effect on intrinsic drives. This is also true in gamified situations where the number of active participants in the gamified experiences is reduced, as may happen when users choose to discontinue participation or the gamification aspect itself is removed (Rapp, 2017). It is interesting to note that Thom et al. (2012) observed that removing game-like elements from implemented systems had a negative impact on user activity and engagement. This has implications the deployment of gamified systems and suggests that in the event of a system needing updating, developers should implement an immediate transition strategy rather than taking a system off-line for modifications (Thom et al., 2012).

The implementation of game elements may improve intrinsic motivation by satisfying users' innate psychological needs for autonomy, competence and relatedness (Deterding, 2014), yet, Vassileva (2012) emphasises the need to design gamified systems that cultivate a sense of accomplishment rather than simply implementing extrinsic rewards. Health gamification research shows that there are significant advantages of leveraging intrinsic over extrinsic motivation, and that interventions which satisfy the innate psychological

needs of autonomy, mastery and purpose to intrinsically motivate behaviour directly contribute to mental and social well-being amongst users (Johnson et al., 2016).

A number of studies suggest that intrinsically-motivating activities are more effective than those which rely exclusively on extrinsic motivation (Deterding et al., 2011; Earle et al., 2018). Hamari (2015) suggests that while badges are an example of extrinsic rewards, the process of earning the badge may be intrinsically motivating. It is interesting to note that studies have shown the use of extrinsic rewards such as badges and points will have a detrimental effect on a person's intrinsic motivation for the task over time (Schell, 2014).

One criticism of gamification that leverages exclusively extrinsic rewards is that it ignores user's intrinsic motivations in favour of points badges and leaderboards (Hamari & Tuunanen, 2014; Rapp, 2017; Werbach, 2014). Robertson (2010) labelled this approach *pointsification*, stating that "what we're currently terming gamification is in fact the process of taking the thing that is least essential to games and representing it as the core of the experience" (Para. 4).

This section has presented literature linking motivation theory to health behaviour-change theory, it has shown that there is a strong relationship between self-efficacy, autonomy, competence, and behavioural outcomes. Furthermore, this section has discussed Self-Determination Theory within the context of gamification. This section has discussed issues relating to the use of intrinsic and extrinsic rewards in gamification, but it has not explained how effective gamification design can influence behavioural outcomes and improve the user experience. These topics will be discussed in the next section.

2.6 PERSUASIVE STRATEGIES IN TECHNOLOGY

The healthcare domain is increasingly leveraging gamification as a design strategy in the development of behaviour change support systems. These are essentially information systems designed to change or reinforce thoughts, attitudes, feelings and behaviours, without the use of deception, coercion or inducement toward behaviour goals (Alahäivälä & Oinas-Kukkonen, 2016). Interactive computing systems designed to influence the attitudes and behaviours of users are known as *persuasive technologies* (Eysenbach et al., 2017). However, Cugelman (2013) stated that "technology is only persuasive when it employs specific behaviour change ingredients" (p. 1). Persuasive design theory may be underutilised in health behaviour change applications (Eysenbach et al., 2017). Persuasive technologies employ persuasive design elements such as persuasive strategies, and these have shown to be effective in health behaviour studies such as smoking cessation (Khaled,

2008; Lehto & Oinas-Kukkonen, 2011), motivating increased physical activity (Berkovsky et al., 2010), and healthy eating (Orji et al., 2012).

Hamari and Koivisto (2013) stated that persuasive technologies and gamification share some common characteristics but are distinct concepts: gamification is concerned with affecting motivations; and, persuasive technologies support behaviour change mechanisms by implementing persuasive strategies. The similarities include mechanisms employed in both concepts, such as feedback and rewards. This distinction is interesting, but not universally supported: Alahäivälä and Oinas-Kukkonen (2016, p. 63) stated that gamification is a form of "persuasive or motivational design"; and Orji, Nacke, et al. (2017) stated that persuasive strategies are a fundamental element of gamified systems.

Persuasive strategies are not unique to gamification; it could be stated that all computer-systems use persuasive strategies to some extent to engage users and to foster continued use. Persuasion relies on strategies that trigger an emotional response encouraging users to take action (Oinas-Kukkonen & Harjumaa, 2009). Humans subconsciously respond to computer systems as if they possessed "emotions, preferences, motivations, and personality" (Fogg, 2003, p. 94). Computer systems can be designed to influence a user's behaviour by replicating human-computer social connections, and then designing the technology to tunnel users toward specific behavioural outcomes using friendly language and creating a sense of inter human-computer relationship (Fogg, 2003; Lehto & Oinas-Kukkonen, 2011).

Extending the early works of Fogg (2003), a series of recent studies identified ten persuasive strategies commonly employed in behaviour change interventions: Cooperation, competition, comparison, self-monitoring and feedback, suggestion, customisation, personalisation, praise, reward, and simulation (Orji, Mandryk, et al., 2017; Orji, Nacke, et al., 2017; Orji et al., 2014). Each of these persuasive strategies is presented on Table 2.7 and will be discussed in the following subsections.

Table 2.7

Persuasive strategies commonly employed in gamification

Persuasive Strategy	Descriptor
Cooperation:	Requires users to cooperate (work together) to achieve a shared objective and rewards them for achieving their goals collectively.
Competition:	Allows users to compete against each other to perform the desired behaviour.
Comparison:	Provides a means for the user to view and compare their performance with the performance of other users.
Feedback:	Allows people to track their behaviours, providing information on both past and current states.
Goal Setting and Suggestion:	Requires users to set a clear behaviour goal and recommend certain actions (for achieving the desired goal to users during system use).
Customisation:	Provides users with an opportunity to adapt a system's content and functionality to their needs and choices
Personalisation:	Offers system-tailored contents and service to its users, tailoring content and functionality to a user's need based on a user's characteristics.
Praise:	Provides positive feedback for the user for performing the target behaviour via words, images, symbols, or sounds.
Reward:	Offers virtual rewards to users for performing the target behaviour.
Simulation:	Provides the means for a user to observe the cause-and-effect linkage of their behaviour.

Adapted from: Fogg (2003); Oinas-Kukkonen and Harjumaa (2009); Orji, Mandryk, et al. (2017); Orji, Nacke, et al. (2017); and Orji et al. (2014).

2.6.1 COOPERATION

Cooperation is a social dynamic that can motivate users to adopt a target behaviour or influence an individual's attitude by leveraging human's innate drive to work together to achieve a common objective (Fogg, 2003; Oinas-Kukkonen & Harjumaa, 2009). Cooperative strategies rewards users for achieving their goals collectively (Orji, Nacke, et al., 2017). Studies show that cooperation is a motivator for increased physical activity, and that connection with family members within a physical activity application leads to

increased motivation and programme adherence (Chen & Pu, 2014). Alahäivälä and Oinas-Kukkonen (2016) found that users exercising together had increased physical activities compared to users exercising alone.

Although cooperation has a positive impact on motivation and behavioural outcomes, cooperative strategies are deployed less frequently in gamification implementations than other strategies (Koivisto & Hamari, 2019). More recently, studies are beginning to consider the impact of persuasive strategies on behavioural outcomes, specifically programme adherence, and continued systems usage. However, while multiple studies identify cooperation as an important strategy in gamification, few studies measure its effectiveness or whether normative beliefs impact an individual's preference for it. Therefore this signifies a knowledge gap in which health-related interventions might be improved (Eysenbach et al., 2012).

2.6.2 COMPETITION AND COMPARISON

Competition and *comparison* are two key persuasive strategies commonly employed in gamification. They are discussed together in this section because some researchers consider them to be quite similar (Orji et al., 2014). Oinas-Kukkonen and Harjumaa (2009) stated that using both competition and comparison in gamified systems is based on the assumption that humans are innately competitive, and therefore users will be motivated to improve performance when they are able to view and compare their performance with the performance of others (Orji et al., 2014). Competition is a popular persuasive strategy with both designers and users, and Akker et al. (2014) found that a competitive element was the main reason users enjoyed a physical activity smartphone application.

Social comparison might be beneficial in encouraging users that are 'less motivated' to commit time and effort into monitoring their physical activity performance (Akker et al., 2014), and therefore, may increase the sense of 'connectedness' and lead to increased engagement. Studies on the effects of social factors in gamified systems indicate that the size of the community committed to the same goals is an important prerequisite for the intervention's effectiveness (Hamari & Koivisto, 2013; Koivisto & Hamari, 2014). Additionally, the size of the community has a positive impact on user perceptions of the benefits from social influence, recognition, and reciprocity (Koivisto & Hamari, 2014).

Comparison techniques, such as allowing people to compare points and badges promotes social benchmarking, is a highly persuasive characteristic of gamification (Hamari & Koivisto, 2015b). Competition and comparison may lead to increased

motivation and confidence for users of health-related applications. In a study exploring the use of gamification to support patients with Rheumatoid Arthritis (RA), Allam et al. (2015) found that implementing a competitive environment where patients were rewarded for exploring and contributing to an RA community, led to an increase in self-efficacy and competence for managing the patient's condition when they were able to compare their online activities and contributions with other users. However, in some cases using a competitive strategy may be inappropriate; Grimes et al. (2009) found that users were uncomfortable using competition to motivate behaviour when their health condition is outside their control as in the case of disease management applications (Hilliard et al., 2014).

The use of a competitive context may have long-term negative effects on user's motivation (Melero-Canas et al., 2021) as adding extrinsic rewards to intrinsically motivating behaviours leads to a decrease in intrinsic motivation for that task (Ryan & Deci, 1999). Furthermore, in some specific contexts such as mHealth applications targeting inactive persons, using competition and social comparison should be avoided as these features might be confronting and lead to low self-esteem, lower self-efficacy, and lower physical-activity programme adherence (Meixner et al., 2020). In contrast, Jakicic and Rogers (2020) found that a competitive context led to significantly increased levels of physical activity sustained over time. In this last example, the participants were competing in teams of four random individuals against teams of four acquaintances to reach and sustain higher daily step-counts.

Eysenbach et al. (2017) and Orji, Nacke, et al. (2017) agree that competition, and social comparison may be counter-productive in health behaviour change applications, specifically where improved personal health is the desired outcome. Orji, Nacke, et al. (2017) found that social comparison may be demotivating as it may reduce self-confidence through downward comparison. Some people may consider such strategies harmful to social relationships. In Orji et al. (2014), participants stated that "comparing the health behaviours and measures of different family members could lead to negative comparison and competitiveness" (p. 474). Although competition and comparison are commonly deployed persuasive strategies in health behaviour change interventions, there is still little research undertaken to indicate the effectiveness of competition compared specifically to cooperation. This indicates a gap in the literature that may be worth exploring further.

2.6.3 FEEDBACK AND SUGGESTION

In commercial health behaviour interventions, accelerometer and GPS based activity-monitoring tools are commonly used (Akker et al., 2014). Real-time *feedback* in the form of visualisations allows people to track their own behaviour and provides feedback on performance and progress (Akker et al., 2014; Orji, Nacke, et al., 2017). Whereas the *suggestion* strategy requires users to set goals, and then the system can recommend certain activities designed to help the user meet their goals (Orji, Nacke, et al., 2017). Orji et al. (2014) found perceived similarities between feedback and suggestion indicating that participants may not have a good understanding of the strategies. This is an important insight for any researcher intending to study persuasive strategy preferences.

Goal-setting and feedback based on performance or progress may have a significant impact on motivation depending how that feedback is perceived by the user (Deterding, 2014). Informational feedback helps users understand how to improve their own performance; this supports the experience of competency, which in turn leads to an increased sense of autonomy. In contrast, feedback perceived as negative or controlling has a negative impact on self-determination (Deci & Ryan, 1985; Deterding, 2014). Direct feedback from other intervention users may positively impact a users' attitude toward using a gamified system, and may also lead to increased goal commitment and programme adherence (Hamari & Koivisto, 2013). This suggests that social interaction and accountability are important features in health interventions.

Suggestion as a persuasive strategy is commonly used in applications aimed at improving chronic conditions as they may offer strategies for coping with a condition (Eysenbach et al., 2012). Using devices such as smartphones to deliver persuasive messages or suggestions at an opportune moment can be an effective way to encourage target behaviours (Oppong-Tawiah et al., 2018).

2.6.4 PERSONALISATION AND CUSTOMISATION

There are multiple strategies that can be implemented into a behaviour change system, and as individuals are all different, it makes sense to adapt an intervention to meet the needs of an individual user, this approach has been called tailoring (Akker et al., 2014; Fogg, 2003). Tailoring has also been called *personalisation*, and *customisation* (Oinas-Kukkonen & Harjumaa, 2009; Orji, Nacke, et al., 2017). While personalisation and customisation are both types of tailoring, Orji, Mandryk, et al. (2017) perceive these strategies differently, and each may be preferred by different users based on typographical characteristics.

Personalisation and customisation increases personal relevance of the gamified system (Oppong-Tawiah et al., 2018). *Customisation* is user-controlled, it allows users to adapt a system's content and functionality to their needs and choices. Examples of customisation include being able to enable or disable certain function, change the user interface, or create bespoke avatars. Whereas *personalisation* is system-controlled, the system dynamically changes content and functionality to meet the individual characteristics or goals of the user (Orji, Mandryk, et al., 2017).

2.6.5 PRAISE AND REWARDS

The concept of *praise* as a persuasive strategy manifests in gamified systems as positive feedback for the user for performing a target behaviour. Oinas-Kukkonen and Harjumaa (2009) found that praise makes users more responsive to persuasion, and may be in the form of words, images, symbols or sounds (Orji, Mandryk, et al., 2017). Fogg (2003) stated that the use of praise in persuasive technologies has a positive impact on user attitude towards the technology. Giving praise, and giving rewards are similar persuasive strategies, as both are incentives for performing the target behaviour, furthermore, offering virtual *rewards* to users for performing the target behaviour is probably the most commonly deployed persuasive strategy (Orji, Mandryk, et al., 2017).

Praise and rewards can both be leveraged to offer positive feedback to users following the completion of a goal (Oinas-Kukkonen & Harjumaa, 2009). Furthermore, Eysenbach et al. (2012) stated that persuasive strategies such as praise and rewards might have positive effects on the outcomes of health interventions. In gamified systems, rewards and incentives are matched to target behaviours to increase a user's motivation to perform that behaviour repeatedly, and to sustain healthy habits over time (Lister et al., 2014). Rewards contingent on performing certain behaviours is an example of extrinsic motivation. Frequently, the target behaviour stops when the external reward ends (Oppong-Tawiah et al., 2018). Ryan and Deci (1999) found that a person's sense of autonomy may be undermined by attaching material rewards to an activity. Paradoxically, adding extrinsic rewards to a behaviour that a person is already intrinsically motivated to perform may reduce the pre-existing intrinsic motivation to perform the action (Deterding, 2014).

2.6.6 SIMULATION

Simulation can be a powerful persuasive strategy as it enables users to observe directly the cause-and-effect relationship of relevant behaviour (Eysenbach et al., 2012; Orji,

Mandryk, et al., 2017). Building on the work of Fogg (2003), Oinas-Kukkonen and Harjumaa (2009) found that simulation supports users to carry out the primary tasks in an application by showing the likely outcome of continuing with a current behaviour. One example to illustrate this point is the use of before and after photos to motivate users in a weight-loss application (Oinas-Kukkonen & Harjumaa, 2009).

This subsection has presented ten persuasive strategies that were identified from gamification literature. It has suggested that commonly implemented socially-oriented strategies such as cooperation and competition may be effective in gamified physical activity and diet interventions. This section has also presented other persuasive strategies that appear to be effective in persuasive technologies. However, although studies show that they are commonly deployed, there is little research into which strategies may be more effective.

2.7 Relating Persuasive Strategies to Behaviour Change and Motivation Theories in Gamification Research

The previous section discussed persuasive strategies, and it could be argued that the implementation of these strategies into technologies results in a form of persuasive technology (Fogg, 2003) that may be useful in health behaviour change interventions. Persuasive strategies stem from a broad combination of motivational and behaviour-change theories such as Self-determination Theory (Ryan & Deci, 1999) and the Reasoned Action Approach (Ajzen, 2012; Fishbein, 2008).

As discussed previously in *Section 2.4: Health Behaviour Change Theories in Gamification,* subjective norms are a determinant of behavioural change (Cugelman, 2013). Studies that explore the effects of attitude and use intentions as a predictor of actual system usage or intention-to-use frequently consider the role of social influence on beliefs and attitude. Socially-oriented persuasive strategies such as cooperation, competition and comparison leverage social influence and contribute to behavioural intention through the perceived expectations of the referent group such as friends and whānau, and the individual's motivation to comply with those perceived expectations (Ajzen, 2012).

Persuasive strategies such as cooperation, competition, and social comparison may be considered socially-oriented strategies, and gamification studies operationalise the social orientation as subjective norms (Hamari & Koivisto, 2015b). Prior studies investigating constructs of gamification have focused on measuring subjective norms, yet Hamari and Koivisto (2015b) stated that these studies do not consider broader aspects

such as which specific persuasive strategies may be effective, nor how specific combinations of game design elements can support each of these strategies. This indicates a gap in the literature that may be worth exploring further.

To date there have been few studies that specifically explore persuasive strategies in the context of broader societal factors such as culture and ethnicity, and Orji and Moffatt (2018) suggest that examining social and demographic variables may provide useful insights into meeting the needs to diverse groups of users. Further to this, there is currently no literature to explain whether cooperative strategies, or competitive strategies are more effective in any health behaviour change context, let alone from a Māori perspective.

Persuasive technologies such as gamified physical activity and diet interventions may be effective tools for supporting behaviour change by deploying various persuasive strategies. Research has shown that tailoring these systems to meet individual's needs can increase their self-efficacy. The literature also suggests that game design elements such as those identified in *Section 2.2.2: Gamification Design Elements* can be used in various configurations to support persuasive strategies. However, it is not known which specific persuasive strategies and configurations of game design elements are more effective than others.

This section has discussed how various previously identified persuasive strategies may relate to the Reasoned Action Approach. It has primarily discussed factors of social influence, as they relate specifically to subjective norms which have a direct influence on behavioural intention. It has also suggested that some of the broader strategies may influence behavioural intention indirectly if they are related to proximal variables. This section also acknowledges that there is a significant gap in the literature that helps explain how broader persuasive strategies might impact attitude or perceived behavioural control.

2.8 CHAPTER SUMMARY

This chapter has explored extant literature pertaining to the use of gamification in health behaviour change interventions. It began by discussing the few Māori-focussed health behaviour change intervention studies that had been conducted. In *Section 2.2* gamification was defined as "the use of game design elements in non-game contexts" (Deterding et al., 2011, p. 10). The concept of gamification was discussed in relation to business, education, and health domains. A search for gamified interventions in health literature yielded twelve relevant studies; these were presented in *Section 2.3*. Each of these

studies were discussed and critiqued. These studies were categorised into four broad domains that summarise the focus of this prior research. The health behaviour change theories adopted in each of these twelve studies was discussed in *Section 2.4*: *Social Cognitive Theory* (Bandura, 1989); *Theories of Reasoned Action* (Fishbein & Yzer, 2003) and *Planned Behaviour* (Ajzen, 2011); and the *Technology Acceptance Model* (Davis, 1989; Davis et al., 1989). Each of these theories is discussed, and this section concludes by presenting the *Reasoned Action Approach* (Ajzen, 2012; Ajzen et al., 2018; Fishbein, 2008) as an alternate theoretical framework. This subsection also introduces an adapted RAA model: The *Reasoned Action Approach (Technology)* adapted from Davis et al. (1989) and Ajzen et al. (2018) and justifies why it is appropriate for this study.

Broadly speaking, many gamification studies also consider motivation as a central theory for creating user engagement. *Section 2.5* discussed Self-Determination Theory as it is highly connected to Health Behaviour Change Theories. *Section 2.6* presented ten persuasive strategies and identified that the inclusion of socially-oriented persuasive strategies such as competition and cooperation may be critical in gamification design. As there is little research to date around persuasive strategy implementation in health behaviour change interventions, it may be important to explore these elements in a gamification study. Finally, *Section 2.7* related the constructs identified in persuasive strategy literature to the health behaviour change theories presented in *Section 2.4* and suggested that there were multiple areas where current literature is lacking, indicating potential research gaps which will be discussed in *Chapter 3: Research Gaps and Questions.*

CHAPTER THREE: RESEARCH GAP AND RESEARCH QUESTIONS

The previous chapter explored health gamification literature and showed that gamified health interventions commonly include persuasive design architectures. The literature review also highlighted several areas where there are few contributions to knowledge. This chapter will present the research gaps and the research questions that were developed to address these gaps.

3.1 RESEARCH GAPS

The literature review conducted in *Chapter Two* has highlighted multiple gaps in knowledge relating to the design of health interventions *with* Māori and the implementation of gamification in an Indigenous context. To date, there is a lack of co-design research relating to the development of health behaviour change interventions in Indigenous and minority populations (Ni Mhurchu et al., 2019), even though previous studies have suggested that culturally-tailored health interventions may be more effective for meeting the needs of these marginalised groups (Khaled, 2008; Osei-Assibey et al., 2010; Robson & Harris, 2007)

Gamification offers an opportunity to design culturally-tailored interventions that create engaging experiences for users (Osei-Assibey et al., 2010), and may be effective in influencing behaviour change within health management (Alahäivälä & Oinas-Kukkonen, 2016). However, there is a lack of guiding theory for gamification implementation, and none undertaken in the Indigenous space. Although gamification has been defined as "the use of game design elements in non-game contexts" (Deterding et al., 2011, p. 10), there is no definitive answer as to what constitutes *game-design elements* (Deterding, 2015; Deterding et al., 2011), and little research to guide practitioners to design engaging interventions.

One approach that shows promise, is to consider gamified health interventions from the perspective of persuasive technologies. Some literature proposes the use of persuasive strategies in the design of health behaviour change interventions (Orji et al., 2014); however, there is little, other than Orji et al. (2014), that relates specifically to gamification, highlighting another opportunity for further research. Persuasive technologies literature does discuss the design of culturally relevant health interventions (Khaled, 2008; Orji et al., 2014), but none of this literature prescribes combinations of game-design elements to

support persuasive strategies. Therefore, a research gap exists to identify persuasive strategy preferences in an Indigenous context, and then to determine how gamification can be deployed to support the persuasive strategy preferences.

While multiple studies exist that show gamification has a positive impact on behavioural outcomes, no studies have explored the persuasive strategy preference for Indigenous people, and no studies have explored whether specific combinations of game design element configurations are more effective for supporting health behaviour change of Māori, the Indigenous population of Aotearoa, New Zealand.

3.2 RESEARCH QUESTIONS

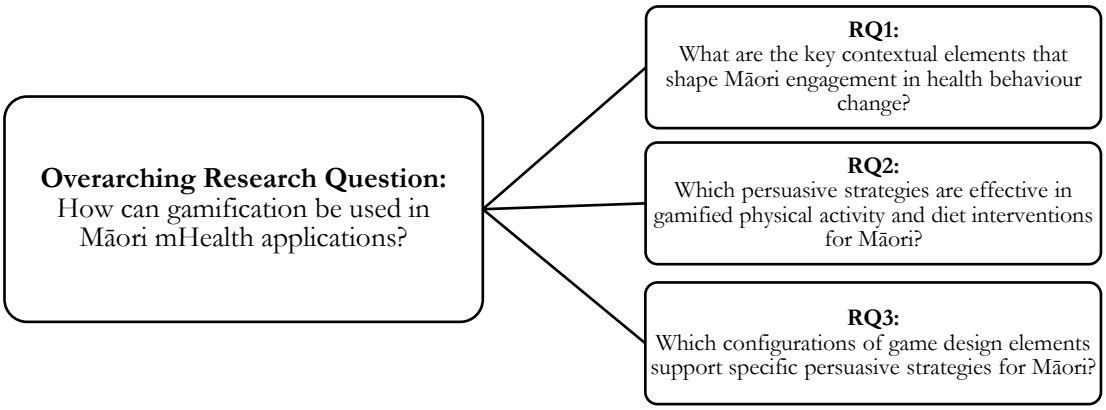
The previous subsection identified multiple research gaps relating to a lack of knowledge around co-designing health behaviour change interventions with Indigenous people, and the implementation of gamification in an Indigenous context. This study is conducted in Aotearoa, New Zealand, and therefore, the current research will address those research gaps specifically in a Māori context by answering the following overarching research question:

How can gamification be used in Māori mHealth applications?

The overarching research question makes several assumptions: That gamification is the focus of the current research; and, that mobile health applications such as those delivered on smartphones are an acceptable platform for the delivery of health behaviour change interventions (Ni Mhurchu et al., 2014). This main research question will be answered by seeking answers to three sub-questions which are presented in Figure 3.1.

Figure 3.1

Research questions



RQ1: What are the key contextual elements that shape Māori engagement in health behaviour change? This research explores the unique Māori social context by understanding the normative beliefs, attitudes, perceptions, and behavioural intentions of Māori participants, and to use a Māori belief system to guide the development of a gamified healthy living intervention specifically targeting encouraging Māori to become more physically active and to make healthy food choices. RQ1 explores the role of referents on an individual's decision-making process and explains the impact of social norms on behavioural outcomes. It explores the role of whānau to understand how Māori social support systems precede behaviour change. Participant's responses to this question will help the researcher to assess their attitudes and perceptions toward health behaviour change applications. Answers to this question will also allow the researcher to determine the role of culture and digital experience on the adoption of gamified technology or applications.

RQ2: Which persuasive strategies are effective in gamified physical activity and diet interventions for Māori? Studies have shown that persuasive strategies are an important element of gamified systems. However, it is not known which strategies are more effective in supporting healthy lifestyle change for Māori. Socially-oriented strategies such as competition and cooperation are the most commonly occurring strategies in persuasive technologies which may suggest they would also be the most effective. This question addresses a lack of knowledge and will assist in developing guidelines for the design of a culturally-tailored gamified physical activity and diet intervention.

RQ3: Which configurations of game design elements support specific persuasive strategies for Māori? In addition to a lack of certainty around persuasive strategy preference or effectiveness, there is a lack of knowledge relating to how different game design elements can be configured to support each of the effective persuasive strategies. This question directly addresses that gap in understanding.

This study will advance knowledge of how mHealth applications should be designed for specific Indigenous populations. It seeks to understand how gamification can be designed into an application to support persuasive strategies. It will thereby extend gamification knowledge from a theoretical perspective by explaining the relationship between behaviour change theory, and persuasive technologies in an application designed specifically to target the social and cultural differences in a specific Indigenous population. The approach to answering these research gaps is addressed in the following chapter.

CHAPTER FOUR: KAUPAPA MĀORI METHODOLOGY

The primary gap identified in *Chapter Three: Research Gap and Questions* is a lack of knowledge about how gamification can be used in Māori mHealth applications. The current research explores an information systems phenomenon of gamification in the context of Māori health. Given that this research has a cultural focus, it is important that a culturally appropriate methodology is employed. It is important to understand Te Ao Māori in the context of Aotearoa, New Zealand's colonial heritage which was previously discussed in *Chapter One: Introduction* and in *Appendix A – Brief History of Aotearoa*, and detailed in the extensive works of King (2003); Orange (2015); and Smith (1999, 2021). *Section 4.1* discusses the impacts of colonisation on Māori research and begins with identifying crucial issues within Kaupapa Māori research, theory, and practice. *Section 4.2* explains why Te Ao Māori (a Māori world view) underpins the philosophical assumptions for this study and justifies the selection of a mixed-methods approach to the research design.

4.1 KAUPAPA MĀORI OVERVIEW

The word *research* itself is contentious in the context of Indigenous people as it reminds colonised people of the worst practices of the imperialist oppressors (Smith, 2021). Smith (2021) also stated that:

> It appals us that the West can desire, extract and claim ownership of our ways of knowing, our imagery, the things we create and produce, and then simultaneously reject the people who created and developed those ideas and seek to deny them further opportunities to be creators of their own culture and own nations (p. 1).

Furthermore, Smith (2021) argues that the collective inter-generational memory of Western research methods has been perpetuated through the ways in which knowledge about Māori was "collected, classified and then represented" by imperial researchers who interpreted and *re-presented* their own versions of knowledge back to Māori from a thoroughly Western perspective: a view which saw Māori as "uncivilised savages" (Mahuika, 2011, p. 16) and regarded as being *less-than* the dominant Pākehā (European New Zealander) population.

Historically, research about Indigenous people produced knowledge that shaped perceptions about Indigenous people leading to racism and stereotypes, which in turn

distorts the Indigenous peoples' perceptions of themselves, defining who they were, and what it means to be Indigenous, and the necessary attributes for being Indigenous (L. T. Smith, 2012). Indigenous research is undertaken from the inside-out, generating "insight into otherwise unknowable worlds" (Houston, 2007, p. 45). Furthermore, the researcher's role is not the impartial outsider, rather, they are a key informant, an insider with an expert perspective of "their own culture and experience" (Houston, 2007, p. 47). The researcher *indigenises* themselves into the community within the research (L. T. Smith, 2012). Kaupapa Māori acknowledges that injustice and oppression exist (Pihama, 2012) and therefore challenges dominant Western philosophical traditions (G. H. Smith, 2015). Walker (1996) stated that Kaupapa Māori is not defined within traditional Western philosophies, rather it challenges and demands to be recognised as a legitimate and valid philosophy in its own right.

Kaupapa Māori is an Indigenous research ideology that is grounded in a Te Ao Māori (Māori world view) framework and epistemology, it is the result of Māori researchers' struggles for tino rangatiratanga (self-determination) and mana motuhake (a sense of power and status which results from self-determination and autonomy). The Kaupapa Māori approach normalises Māori ideologies, values, language, culture, and ways of doing things, within a culturally-defined space (Pihama, 2012), while making a positive contribution to Māori communities (Hayward et al., 2017). Kaupapa Māori is a deliberate effort by Māori academics to challenge Western research approaches, and for some Pākehā (European New Zealanders), this is confronting as Māori evolve from being the research *subject*, to being the researcher (Pihama, 2012).

Indigenous researchers such as Pitama et al. (2011); Singh and Major (2017); L. T. Smith (2012); and Walker et al. (2006) challenge Western-centric research methodologies by "articulating and thus reclaiming their peoples' research methodologies and paradigms" (Held, 2019, p. 2). Indigenous methodologies such as Kaupapa Māori attempt to ensure that research is culturally respectful and places the emphasis on marginalised groups, and an emancipatory stance (Held, 2019). The core principles of Indigenous research are demonstrating empathy, mutual respect, and a culturally-ethical approach (Kovach, 2010; Singh & Major, 2017). Each Indigenous group has different ways of knowing: "Indigenous methodologies can be situated within the qualitative landscape because they encompass characteristics congruent with other relational qualitative approaches (e.g., feminist methodologies, participatory action research)" (Kovach, 2010, p. 24). This

research is driven by Te Ao Māori and explores Kaupapa Māori to understand how it influences this study.

Kaupapa Māori research offers a framework for Māori to engage in *culturally-safe* (Irwin, 1994) research that builds on mātauranga Māori (customary knowledge), and it recognises that Te Reo (Māori language) and tikanga (cultural protocols) are valid in their own right (McCabe et al., 2014). Previous co-designed Māori health intervention studies such as Te Morenga et al. (2018) and Oetzel et al. (2017) have demonstrated that a Kaupapa Māori approach puts Māori perspectives at the centre of the study and recognises that the generation and sharing of knowledge is a collective effort for the benefit of both researcher and the Māori community. Kaupapa Māori also indicates a Māori world view of research philosophy and strategy, and how these relate to Māori beliefs and values (Pihama, 2012).

4.2 TE AO MĀORI (THE MĀORI WORLDVIEW)

Every researcher has a personal philosophy or general belief about how data should be collected, analysed, and used; thus, bringing a unique perspective and set of life experiences to their study, which in turn shape the research project and influence the broad approach the researcher will assume. These philosophical beliefs and various assumptions associated with a particular 'view' of research are known as '*paradigms*' (Burrell & Morgan, 1979; Teddlie & Tashakkori, 2009) or as '*worldviews*' (Creswell, 2014).

Kaupapa Māori is a search for understanding within a Māori worldview, yet it challenges accepted norms and assumptions about knowledge, and the way knowledge is constructed (Moewaka-Barnes, 2000). This kaupapa challenges Western ideologies and states the worldview of the researcher is integral to the study, and as such should not be compared with dominant paradigms. It assumes the existence of the rights of Māori to tino rangatiratanga (self-determination) and to address research problems that impact Māori.

Te Ao Māori (Māori world view) is the epistemological lens through which Māori view the world (Hudson, 2020), it represents the cultural, historical and contemporary experiences of Māori that shape shared values and social perspectives (White, 2016). Young (2002) stated that "different social groups have different needs, cultures, histories, experiences, and perceptions of social relations which influence their interpretation" (p. 137), and further stated that although a cultural group, such as Māori, will share a *perspective*

and that perspective will be different from that of non-Māori, individuals hold a unique interpretation, assumptions and draw their own conclusions and preferences.

One underpinning aspect of a shared Te Ao Māori world view is a sense of cultural identity; Durie (1998) explains that cultural identity is facilitated through four key markers: *whakapapa* (identity); *mātauranga* and *tikanga* (knowledge and understanding); *whakaurunga Kaupapa* (access and participation); and *te reo* (language and communication). These markers were adapted from Durie (1998), who stated that the most important of these markers is whakapapa (identity).

Whakapapa is often expressed as a verbal recitation of an individual's genealogy (White, 2016), it describes an individual's connections to waka (the canoe ancestors arrived in); to maunga (mountain); awa (river); tipuna (ancestors); iwi (tribe) hapū (sub-tribe); whānau (family); and marae (sacred meeting ground). Whakapapa allows a Māori person to describe their place in the world in such a way that is clearly understood and accepted by other Māori. However, Māori are connected in ways that transcend familial links, Barlow (1994) defines whakapapa as the "genealogical descent of all living things from the gods to the present time" (p. 173). In Māori culture, geological features such as mountains, rocks, rivers, and seas are considered *living things,* and therefore also have whakapapa. Geological features are often seen as the embodiment of deities "including the *rangi* (sky), *whenua* (earth), *ngahere* (forests), *moana* (oceans) and *huarere* (weather)" (White, 2016, p. 178).

Central to an individual's cultural identity and Te Ao Māori (worldview) is mātauranga (knowledge and understanding), and tikanga (cultural protocols). Mātauranga is about knowledge, in this context it is used to explain an understanding of *tikanga*. Tikanga grounds an individual in the customary social practices within Te Ao Māori (White, 2016) and ensures that the individual knows the social rules surrounding each specific context. This might include the recitation of whakapapa, or the use of waiata (song), whakataukī (proverbs), and understanding the importance of manākitanga (hospitality) in various contexts.

Whakaurunga Kaupapa (access and participation) describes the extent to which an individual engages with Māori institutions such as marae (sacred meeting grounds) (Durie, 1998; Durie et al., 2017; White, 2016). An individual's engagement with Māori institutions is an indicator of tikanga, and mātauranga. Durie (1998) also stated that Te Reo Māori (Māori language) and communication is an important aspect of cultural identity. It has been argued that the use of Te Reo Māori has a significant impact on an individual's

perceptions of their cultural identity, and their ability to hold a Te Ao Māori perspective (White, 2016).

Te Ao Māori (a Māori worldview) comprises an individual's knowledge of their whakapapa: who they are, and where they come from, and furthermore, it requires an individual to understand and respect tikanga (cultural protocols), connect with and respect community, and respect the Māori language. The following subsections will reconcile the researcher's philosophical assumptions with the research questions to justify the research design of this study.

4.2.1 ONTOLOGICAL ASSUMPTIONS OF THE RESEARCHER

Henry and Pene (2001) consider the meaning of Kaupapa Māori is embedded in Māori culture, and as such, it encompasses both philosophical assumptions and tikanga (cultural protocols). What is more, they stated this belief is:

> founded on the collective (whānaungatanga) interdependence between and among humankind (kotahitanga), a sacred relationship to the 'gods' and the cosmos (wairuatanga), and acknowledgement that humans are guardians of the environment (kaitiakitanga), combining in the inter-connection between mind, body and spirit (p. 237).

In this sense, the ontological assumptions for Māori health research are holistic, and include the interrelationships between wairua (spirit), tinana (body), whānau (family), and hinengaro (mental) (Durie, 1984).

The purpose of this study is to understand how gamification can be used in mobile health applications to encourage Māori to be more physically active and to make healthy food choices. Knowledge and understanding of gamification in this context will be derived from the shared knowledge and experiences of Māori, and this study assumes that technologies developed will be Māori-centric and address specific research questions.

This research assumes the principle of tino rangatiratanga, that is, that Māori have the right to determine and identify solutions to Māori issues, particularly in the health domain. Furthermore, the current research assumes that tikanga (customs) and mātauranga Māori (knowledge) are explored for the benefit of all Māori, and that knowledge created belongs to Māori collectively. The current research also assumes a holistic approach to problem solving, by assuming that any artefacts developed for this research will address tinana (the body), hinengaro (the mind), wairua (the spirit), and te whānau (the family).

4.2.2 EPISTEMOLOGICAL ASSUMPTIONS OF THE RESEARCHER

Epistemology is concerned with the theory of knowledge, it is the study of the origin and acquisition of knowledge, and addresses the relationship between the researcher, and what can be known about the nature of reality (Guba & Lincoln, 1994). Mātauranga Māori (Māori customary knowledge) offers guidelines for accessing, analysing, organising, retrieving, and making sense of data, and requires the researcher to reflect upon their role within the research (Mead, 2016). Mātauranga Māori is knowledge of tikanga (cultural protocols) and how these ancient practices dynamically adapt to encompass new technologies, new information, and the collective knowledge of people (Durie et al., 2017; Hudson, 2020; Mead, 2016). The researcher claims that knowledge about how technologies can support Māori health are objectively constrained and relevant to a specific context. Furthermore, meaning and mātauranga Māori is derived from iteration, creation, and interaction between researcher, participants, and community.

4.2.3 METHODOLOGICAL ASSUMPTIONS OF THE RESEARCHER

Methodology is the researchers' rationale for the selection of interrogative instruments used in the study (Teddlie & Tashakkori, 2009), or, how the researcher chooses to learn about what can be known (Guba & Lincoln, 1994). This section discusses the researcher's methodological assumptions and explains how Kaupapa Māori reconciles with a design-science methodological process. The current research explores a very specific research problem, which occurs in a unique context. Firstly, it asks *how can gamification support health behaviour change?* Secondly, it explores the research question in the specific context of an Indigenous population – New Zealand Māori.

Research concerning the health of Indigenous peoples such as Māori must occur in a mutually respectful manner, one that recognises cultural differences (World Health Organization, 2019). The current research honours the rights of Māori to tino rangatiratanga (self-determination) afforded under Te Tiriti (the Treaty), which is considered the founding document of Aotearoa, New Zealand and assumes rights for Māori sovereignty and self-governance. The researcher holds the assumption that to study Māori issues requires a deep respect for Māori cultural practices, customs, knowledge, language and ethics (L. T. Smith, 2012). Specifically, in the current research the kaupapa Māori approach will inform the co-design process. It will ensure the rights of tino rangatiratanga are asserted. Questions in the hui will ask about the lived experiences of Māori participants; hui will be conducted bilingually in the preferred language of the participants, and a translator will attend all hui; Hui will demonstrate the principles of

joint knowledge, sharing, and generosity. The role of the researcher in the hui is as a discussion facilitator, an explainer of concepts, as a student of knowledge, and as kaitiaki – a guardian and curator of design ideas.

To answer the proposed research question, it is critical to learn about, and understand, how mobile health technologies are perceived by Māori, and to understand the unique contextual issues relating to how they might be used by Māori. The current research should seek to understand the context prior to exploring how any technology should be implemented. Therefore, the research question has both social and technological dimensions, and requires *understanding* of the issues before trying to *solve* the problem (Niehaves, 2007). The matrix illustrated in Figure 4.1 summarises these perspectives.

Figure 4.1

Socio-technical approach to the research question

	Problem Understanding	**Problem Solving**
Māori Health (Social)	What is the specific context?	How best to solve the problem?
Gamification (Technological)	Which technological approaches are beneficial?	How should technology be implemented?

Reconceptualised from Hevner et al. (2004)

Methodologically, the *problem-understanding* to *problem-solving* approach in information systems (IS) research is usually associated with design-science (Hevner et al., 2004), yet a participatory approach to the study design is also critical to ensure the voices of impacted people are central to any problem-solving approach.

To address the overarching research question, it is first necessary to explore the contextual elements that shape engagement with Māori health initiatives, from the perspective of Māori (RQ1). It will also be valuable to explore perceptions around which persuasive strategies might be effective for Māori (RQ2); and which configurations of game design elements would support these specific strategies (RQ3). To answer these questions, a participatory or collaborative, qualitative approach is entirely appropriate. Participants' perceptions of what *might* be effective are immensely valuable for designing a prototype; however, this would not answer the question about whether specific strategies *would* be effective, or the degree to which the effectiveness of gamification constructs might quantitatively be measured.

Therefore, the most appropriate methodology for this research is a mixed methodology study consisting of two phases. Phase One is an exploratory study looking at how gamification might be used to support Māori health. Outcomes from this phase would include a gamified prototype of an mHealth intervention targeting increased physical activity and healthy food choices for Māori.

Phase Two of this research will evaluate the prototype to determine which constructs of a gamified intervention are most effective for supporting Māori to live healthy lifestyles. As Phase One will inform Phase Two, the research design of Phase One will be presented in *Chapter Five: Phase One Research Design*, followed by findings and discussion, then the research design of Phase Two will be presented in *Chapter Eight: Phase Two Research Design*.

4.3 CHAPTER SUMMARY

This chapter has discussed Kaupapa Māori as an approach to research that uses tikanga Māori (Māori cultural protocols) in all aspects of the study. It embraces tino rangatiratanga (self-determination) and builds on mātauranga Māori (customary knowledge). It recognises that Māori language, customs, and knowledge are valid in their own right (Came & McCreanor, 2015). Kaupapa Māori is a collaborative approach (Te Morenga et al., 2018) that puts Māori perspectives at the centre of the study and recognises that the generation of knowledge is shared and may have a positive impact on health outcomes (Oetzel et al., 2017).

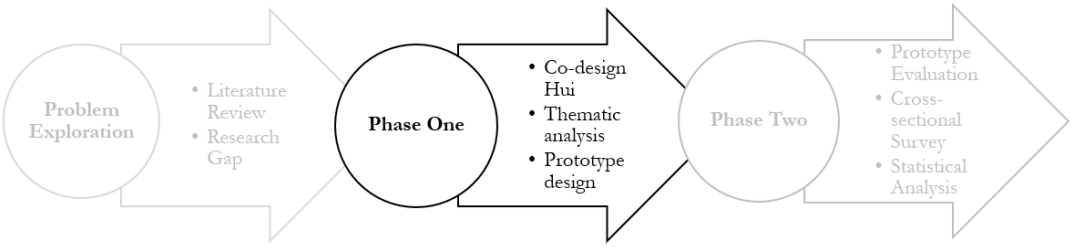
This chapter has also discussed the impacts of colonisation on Māori research, it has shown that Kaupapa Māori research, theory, and practice and Te Ao Māori (Māori world view) are critical aspects underpinning Māori research today. It challenges the assumptions of Western philosophies and argues that Kaupapa Māori is a valid ideology in its own right. This chapter has also argued that the principle of tino rangatiratanga (the right to self-determination) is a critical aspect of any research that impacts Māori and guarantees Māori a voice in identifying solutions. Philosophical assumptions held by the researcher are presented and this study has been positioned within socio-technological problem-solving methodologies commonly associated with information systems (IS) research. The next chapter will outline the research design for Phase One and will argue that following a design-science process reconciles Western IS research methodologies and Kaupapa Māori practice.

CHAPTER FIVE:
PHASE ONE RESEARCH DESIGN

This chapter discusses the strategic decisions made for data collection, data analysis, participant selection, and ethical considerations for Phase One of this research. Each subsection justifies the approach taken and describes the activities or processes followed for each major decision. *Chapter Four*: *Kaupapa Māori Methodology* discussed the underlying assumptions of the researcher; this chapter discusses how and why a design-science research (DSR) process is implemented around Kaupapa Māori principles. *Sections 5.1 to 5.6* describe the DSR activities undertaken in Phase One. Then, *Section 5.7* explains the participant selection strategy. *Section 5.8* explains why the appropriate data collection strategy for Phase One is multiple co-design hui, and *Section 5.9* explains why the codebook version of thematic analysis is suitable as a data analysis method. *Section 5.10* explains the ethics processes followed. Phase One is designed to partially address the questions previously discussed in *Section 3.2: Research Questions*. Outcomes of Phase One will inform Phase Two; this is illustrated in Figure 5.1

Figure 5.1

Overview of the research design: Phase One



Given that research concerning the health of Indigenous people, such as Māori, should be undertaken collaboratively (World Health Organization, 2018), several collaborative approaches were candidates for the current research as they have been employed previously in health behaviour research: Design Thinking (Mora et al., 2017; Raftopoulos, 2014); Participatory Action Research (Benito-Santos et al., 2021; Heffernan et al., 2014); Co-design Research (Eyles et al., 2016; Harding et al., 2021; Oetzel et al., 2017; Te Morenga et al., 2018); and Design Science Research (Fitz-Walter, 2015; Knutas et al., 2019; Oppong-Tawiah et al., 2018). Ultimately, each follows a very similar process, and a Design Science Research (DSR) approach was selected because it was developed for use in information systems (IS) research, and it has previously been adopted in gamification studies.

One of the challenges of this study is to position Kaupapa Māori within information systems (IS) research; to date, little research has been conducted which attempts this. It is not uncommon that theories from other disciplines are applied to problem-solving in IS research (Peffers et al., 2007), and this often requires researchers to design solutions to very specific, contextually driven problems (March & Smith, 1995). One approach to IS research involves designing new and innovative artefacts such as constructs, models, methods and instantiations (Gregor & Hevner, 2013; Hevner et al., 2004; Peffers et al., 2007). This approach is called design science research (DSR). Beyond the IS discipline, DSR has a rich history for the creation of novel solutions to specific and contextual design problems in fields such as engineering and architecture (Hevner & Maedche, 2019).

There is a sense of consensus within the DSR community that to conduct DS research, the researcher needs to follow a series of generic stages (Hevner & Chatterjee, 2010; Hevner et al., 2004; Peffers et al., 2007; Vaishnavi & Kuechler, 2015) as listed below:

1. Identify the problem and motivation
2. Define the objectives of a solution
3. Design and develop the artefact
4. Demonstrate the artefact
5. Evaluate the artefact
6. Communicate and disseminate the findings

These nominal processes are referred to by design-science researchers as the basic steps to follow when conducting DSR in information systems, yet, these generic steps are presented as overarching guidelines and offer little in the way of prescriptive instruction (Yang, 2018). However, this lack of operational-level instruction does offer benefits to the researcher as it could be argued that a lack of formal structure allows researchers to innovate and be creative, particularly with respect to digital innovation (Hevner & Maedche, 2019).

While the generic steps are presented above, much of the more recent work presenting DSR process frameworks builds on Peffers et al. (2007) and therefore this subsection gives a brief explanation of each the activities typically undertaken in the DSR process as described by Peffers et al. (2007). The following subsections describe how this process was followed in Phase One and explains how each of the activities was implemented. Table 5.1 summarises the process followed in this research and identifies each of the activities undertaken in the current research.

Table 5.1

Summary of research activities for the current research

DSR Process		Research Design Activities
1	Identify problem and motivation	Preliminary discussions with healthcare practitioners Preliminary discussions with health app developers Preliminary discussion with health intervention researchers Aotearoa, New Zealand Context (see *Chapter One: Aotearoa, New Zealand Context*) Literature review (see *Chapter Two: Literature Review*)
2	Define the objectives of a solution	Identify technology gaps (see *Chapter Two: Literature Review*) Identify design/research gaps (see *Chapter Three: Research Gap*)
3	Design and develop the artefact	Develop card artefacts (from literature) Co-design hui – data collection Data analysis: Identify key design mandates Artefact design (iterative process)
4	Demonstrate the artefact	Demonstrate artefact to previous hui participants Feedback from previous participants and stakeholders Modifications (iterative cycle)
5	Evaluate the artefact	Survey Instrument Demonstrate prototype to wider Māori audience Evaluate prototype against theoretical constructs Statistical data analysis
6	Communicate and disseminate the findings	Thesis Conferences (various)

Adapted from (Peffers et al., 2007)

5.1 ACTIVITY 1: IDENTIFY PROBLEM AND MOTIVATION

As discussed by Hevner et al. (2004), IS research problems are unique within the a specific context, and possible solutions are dependent on the socio-technological DNA of a specific target audience. As the problem definition will be used to design and evaluate the solution, it is necessary to explicate the problem in as much detail as possible. This assists stakeholders to evaluate the potential of a proposed artefact for utility and performance (Peffers et al., 2007), a concept Hevner et al. (2004) refer to as *relevance*.

The researchers' primary area of interest for this study is in gamification and its potential applications in health. As the process of a doctoral study requires the researcher to meet preliminary milestones including a research proposal with a clearly defined purpose and research plan, it was necessary to have an idea of the type of problem to search for before beginning data collection. As such, the research direction was informed by meetings with several groups, such as:

- Multiple meetings with Māori diabetologists, Māori health and public health practitioners, and diabetes support agencies to understand what type of problems were of primary concern in relation to Māori health specifically.
- Discussions with Māori-health researchers and health intervention researchers for early-stage feedback on potential directions for the study.
- Meeting with a health-intervention software development business to discuss conceptual ideas and elicit early-stage feedback on potential directions for the study.

These preliminary meetings confirmed that there are significant differences in the overall health of New Zealand Māori compared to non-Māori, and that gamification might be useful in the development of health behaviour change interventions. The potential for gamification to support health behaviour change has been discussed previously in *Section 2.2.2: Gamification Design Elements* and will therefore not be repeated in this section. To understand the context of Māori health, the researcher examined previous research and social commentary from Māori academics that discuss the contributing factors of Māori health inequities and systemic racism that occur in Aotearoa, New Zealand, see *Section 1.1: The Aotearoa, New Zealand Context.* This discussion explores current and historical issues such as repetitive and ongoing Treaty violations, social inequities and systemic racism that underpin the over-representation of Māori in poor health statistics today. The combination of multiple meetings, discussions and a review of Indigenous issues led to a preliminary understanding of the social context and focus for this study.

The formal research problem identification process begins with the exploratory literature review in *Chapter Two*: *Literature Review*. This revealed gaps in earlier gamification research, particularly concerning gamified physical activity and diet interventions, which were discussed in *Chapter Three: Research Gap and Questions*. The next subsection discusses how the research gap helps define the scope of the project.

5.2 ACTIVITY 2: DEFINE THE OBJECTIVES OF A SOLUTION

The objectives of a solution are inferred from the problem specification, this requires an understanding of the nature of the problem domain and an understanding of current solutions and their efficacy (Peffers et al., 2007). In this research, defining the objectives of a potential solution means understanding the technological gaps and understanding the current solutions and their efficacy. Peffers et al. (2007) stated that to determine the

objectives of a solution, it is first critical to understand current solutions and their efficacy. The literature review in *Chapter Two* identified a lack of literature pertaining to the use of gamification in health behaviour change for Indigenous people. However, it is possible to identify objectives for the artefact that align with the research questions in the current research:

RQ2: Which persuasive strategies are effective in gamified physical activity and diet interventions for Māori?

RQ3: Which configurations of game design elements support specific persuasive strategies for Māori?

5.3 ACTIVITY 3: DESIGN AND DEVELOP THE ARTEFACT

Creating the artefact as a solution to the research problem is the next activity. As previously discussed, examples of artefacts include constructs, models, methods, and instantiations (Gregor & Hevner, 2013; Hevner et al., 2004; Peffers et al., 2007). "Conceptually, a design research artifact can be any designed object in which a research contribution is embedded in the design" (Peffers et al., 2007, p. 55).

There are multiple artefacts developed for use in this study. Initially, two sets of artefact cards were developed for use in a series of co-design hui: Set one contains ten persuasive strategies cards and set two contains ten game mechanics cards. The development and use of these artefacts is discussed in *Section 5.8*: *Data Collection Strategy*. The main output artefact of Phase One is a non-interactive prototype of a gamified physical activity and diet intervention called *Hīkoi to Health* (*Walk to Health*) The development of this prototype is discussed in *Chapter Seven*: *Phase One Discussion*, it followed an iterative process of interpretation and revision, comparing what different groups of participants had discussed; it considered where their ideas converged, and where they differed. Another artefact output from this research is a series of guidelines for the implementation of gamification into Māori health initiatives. These guidelines are presented in *Chapter Seven*.

5.4 ACTIVITY 4: DEMONSTRATE THE ARTEFACT

Peffers et al. (2007) and Hevner and Chatterjee (2010) include demonstration in their DSR process models. The notion of demonstration could be likened to a proof-of-concept where an example of the artefact can be presented to show it works (Gregor & Hevner, 2013). Demonstration requires that the researcher can link practice to theory and

process, and it supports rigour through the selection and application of relevant theories (Hevner et al., 2004).

Development of the non-interactive prototype, *Hīkoi to Health* was iterative, and multiple instances of feedback and modifications were included before the design was finalised for demonstration. The design of the prototype, the iterative process, and the research design for Phase Two are discussed in *Chapter Eight: Phase Two Research Design*. Participants and stakeholders were sent a finalised version of the prototype for final feedback before it was reviewed by a wider audience of 377 respondents. Activity 4 (Evaluation) was undertaken during Phase Two of the research project; and 5 (Communication) was undertake throughout the research project.

5.5 ACTIVITY 5: EVALUATE THE ARTEFACT

This activity compares the objectives identified in Activity 2 with demonstration in Activity 4 to determine how well the artefact solves the research problem. Conceptually, rigorous evaluation could include any appropriate techniques such as experimentation, or field study. Rigour itself is demonstrated in the selection and application of appropriate methods grounded in theory (Peffers et al., 2007).

Phase Two of the current research explores the perceptions and efficacy of the *Hīkoi to Health* prototype from the perspective of a general Māori population. This research determined that a survey instrument to assess the prototype against constructs from gamification, motivation, and health behaviour change theories would provide the basis to determine its efficacy. Results are presented in *Chapter Nine: Phase Two Results*, and implications from the evaluation activities are discussed in *Chapter Ten: Discussion, Conclusions, and Limitations*.

5.6 ACTIVITY 6: COMMUNICATE AND DISSEMINATE FINDINGS

Multiple authors such as Archer (1984), Hevner et al. (2004), and Peffers et al. (2007) stated that communication of the research problem and its importance, along with the utility and novelty of the artefact, the rigour of its design, and the effectiveness of the solution is important. Audiences for such communication should include researchers, practitioners and other stakeholders. This communication is an effort to disseminate the research to improve both the knowledge base and to improve practice (Hevner et al., 2004; Peffers et al., 2007). The researcher has presented preliminary findings from this study at relevant conferences: *New Zealand Information Systems Doctoral Consortium* (NZISDC) 2018;

Health Informatics New Zealand (HiNZ) Conference 2019; and the *Centre for Health Systems and Technology* (CheST) Symposium 2020. Of course, the production of this thesis is currently the primary effort to disseminate these findings, and future works will include publishing findings in peer-reviewed academic journals.

So far, this subsection has explained why this study follows a design science research process and identified each of the steps undertaken as part of that process. The next subsection will explain the data collection strategy implemented and explain how Kaupapa Māori principles are incorporated into the data collection process.

5.7 PARTICIPANT SELECTION STRATEGY

The process of identifying participants who will enhance the researcher's understanding of the phenomena being studied is a fundamental dimension of research design (Sargeant, 2012). Reybold et al. (2012) stated that participant selection decisions are a "conscious and deliberate" (p. 700) judgement that directly impacts the research design. Furthermore, participant selection decisions influence the nature of the data collection style and data analysis techniques deployed in the research. Previous studies of health intervention design have employed purposive, convenience sampling techniques (Eyles et al., 2016), as these ensure participants "fit the purpose of the study, the resources available, the questions being asked, and the constraints faced" (Patton, 2015, p. 308).

While larger numbers of participants are desirable in quantitative research, fewer participants are typically studied in qualitative studies. Qualitative samples need to be large enough to ensure that important perspectives are revealed; and interviews or focus groups can be discontinued when no further new concepts emerge from the data. This endpoint is called *data saturation* (Sargeant, 2012). Mason (2010) stated that a single occurrence of data supports its inclusion in the findings and does not require the researcher to find multiple existences of the same phenomenon. The *point of diminishing returns* stated that more data does not necessarily result in more information (Mason, 2010).

Participants in this phase of the research were purposively selected to represent the substantive area of study (Creswell, 2003; Urquhart & Fernández, 2013), which is the use of gamification in Māori health behaviour change interventions. The current research is bound by time and resources, and as such, participants were selected through a series of recruitment techniques including recruitment posters placed in high-traffic locations such as libraries, locations across the University of Waikato campus, and publicly accessible physical and digital noticeboards. In addition, the researcher set up a website and a

Facebook page for the study. There was a requirement that participants should be aged over 18 and identify as New Zealand Māori. To ensure the integrity of this criteria, participants were asked to identify which iwi they belong to when they registered their interest in participating.

The co-design hui programme for the current research was developed in conjunction with Māori advisors; it was based on a similar programme described in Te Morenga et al. (2018). The final hui programme is appended to this thesis in *Appendix G – Hui Process and Example Questions* and discussed in *Section 5.8: Data Collection Strategy*. A pilot hui was conducted on the University of Waikato campus, and students who identify as Māori were invited to attend. Following the pilot, two additional hui were conducted. The decision not to hold additional hui was made after the analysis of data from the third hui revealed no new themes. Table 5.2 briefly describes each of the participants. The participants are listed in the order they spoke first during their individual hui. All participants self-identify as Māori; seven participants are male, and five participants are female. Participants will be referred to in the data analysis by the participant ID number.

Table 5.2

Participant profiles

Hui Code	Participant ID	Is Māori	Iwi	Age	Gender
19/285	19/285 #1	Yes	Ngāti Tūhoe	45-54	Male
19/285	19/285 #2	Yes	Ngāti Maru	18-24	Male
19/285	19/285 #3	Yes	Ngāti Kahungunu	18-24	Male
19/109	19/109 #1	Yes	Tainui	45-54	Female
19/109	19/109 #2	Yes	Te Arawa me Tainui	45-54	Female
19/109	19/109 #3	Yes	Ngāti Kahungunu	18-24	Male
19/109	19/109 #4	Yes	Ngāti Tūwharetoa, Te Whānau-a-Apanui	55-64	Male
19/109	19/109 #5	Yes	Ngāti Kahungunu	25-34	Male
19/310	19/310 #1	Yes	Ngāti Raukawa	35-44	Female
19/310	19/310 #2	Yes	Ngāpuhi	25-34	Female
19/310	19/310 #3	Yes	Ngāti Tūhoe	18-24	Male
19/310	19/310 #4	Yes	Ngāti Apa	25-34	Female

Table 5.3 categorises participants by gender and age. It also provides a count of how many participants were in each category. All participants were aged between 18 and 64;

four were aged between 18 and 24 years; three were aged between 25 and 34 years; one was aged between 35 and 44 years; three were aged 45-54 years; and one was aged between 55 and 64 years. No specific effort was made to balance gender and age groups.

Table 5.3

Participant demographics

Gender	**Participant count**
Male	7
Female	5
Age Groups	
Aged 18-24	4
Aged 25-34	3
Aged 35-44	1
Aged 45-54	3
Aged 55-64	1

5.8 DATA COLLECTION STRATEGY

To understand the nature of how gamification can support Māori to make healthy lifestyle choices it is important to understand attitudes, beliefs, and perceptions of Māori toward the efficacy of health behaviour change interventions. As previously discussed in *Chapter Four: Kaupapa Māori Methodology,* the right to tino rangatiratanga (self-determination) is an important aspect of Indigenous research. One way to ensure that the outcome of this research meets the needs of the Indigenous community is through a series of culturally respectful hui. The word *hui* has multiple meanings; usually, it means meetings, and for this study, the term hui is used to describe design-oriented focus groups.

It could be argued that the Kaupapa Māori approach taken to develop the design-oriented hui employed as a data collection strategy in this research are inherently like community-based participatory research methods as described by Eyles et al. (2016); and Israel et al. (1998). Both share core values such as being participatory and relying on a degree of cooperation between partners. They are also both about co-learning and a mutual exchange of ideas. The researcher accepts that in the context of a different research design, the methodological decisions could generically be labelled participatory research, as is the nature of Kaupapa Māori research.

The design of the hui programme was developed and refined in several ways. Initially, the researcher identified previous research that had followed tikanga Māori (cultural protocols), customs and methods (see Hayward et al., 2017; Kara et al., 2011; Kerr et al.,

2010; Te Morenga et al., 2018 for examples). In addition, the researcher shared the proposed hui programme with Māori mentors, Te Reo (Māori language) speakers, and various other Māori researchers experienced in running hui. Each hui begins with a karakia timatanga (opening prayer) which is an incantation used to invoke spiritual guidance and protection. Karakia connect Māori spiritually (L. T. Smith, 2015) in a scared state and space (Lee-Penehira, 2015). Karakia are followed by mihimihi (introductory speeches) and manāki (hospitality). A kai karakia (food prayer) was offered by a participant, and then the hui followed a casual kai-mahi form of hospitality, which literally translates into sharing food and working together. Each hui contained several stages: beginning with issues understanding, persuasive strategies discussion and interactive activities, game mechanic activities and discussion, and finally, idea generation brainstorming. Hui concluded with a wrapping-up karakia, and thanks to each participant. The finalised hui programme is included as *Appendix G – Hui Process and Example Questions*.

One important aspect of the hui programme was the development of discussion card artefacts. There are two sets of ten cards; one set consists of ten game-mechanics concepts, and the other, shows ten persuasive strategy concepts. These concepts are informed by the literature and were previously discussed in *Sections 2.2.1* and *2.7.1*, respectively. The persuasive strategy concept cards are shown in Figure 5.2.

Figure 5.2

Persuasive strategies concept cards

As the researcher is not fluent in Te Reo Māori (Māori language), the concept titles and descriptions were translated from English. Translations were made using the online Māori Dictionary and verified by two fluent Te Reo speakers. Titles appear in both Te Reo Māori (Māori language) and English; Taonga tuku iho (the principle of cultural aspiration) asserts the significance and authenticity of Te Reo in Māori research (Smith, 1990) and therefore,

placing Te Reo before English signals that the English text is less important. However, it was determined that English only would be used for descriptions as potential participants would be able to read English, but may not be fluent in Te Reo, so to minimise the risk of potentially embarrassing the participants, this decision was made prior to recruiting participants. Table 5.4 summarises the titles, their respective translations, and a summary of the concept. There is a discussion of the design strategy behind the cards in *Appendix F: Design of Card Artefacts.*

Table 5.4

Summary of persuasive strategy card descriptions

Concept Title (Te Reo)	Concept Title (English)	Concept descriptor is rewritten into everyday language
Whakatauritenga	Comparison	Allows a person to see and compare his/her performance with the performance of other users.
Whakataetae	Competition	Allows people to compete and rewards the highest achievers for reaching their goals individually.
Mahi Tahi	Cooperation	Requires people to work together to achieve a shared goal, and rewards them for reaching their goals collectively
Āhuatanga urutau	Customisation	Allows a person to adapt an app's contents and functions to suit their own choices.
Whakahoki kōrero	Feedback	Allows people to track their own behaviours and provides information on past and current states.
Tautuhinga	Personalisation	The app automatically changes content and services based on the user's characteristics.
Mihi	Praise	Congratulates the user for achieving a goal or completing an in-app behaviour. It uses words, images, symbols, or sounds to give positive feedback.
Momoho	Reward	Rewards are given to users for performing the desired behaviour or completing a task
Whakataruna	Simulation	Simulation shows the user what the outcomes of their current behaviour might be.
Marohi	Suggestion	The app suggests certain tasks, which have favourable behavioural outcomes, to users while they are using the app.

Modified from Orji, Nacke, et al. (2017)

During the hui, each participant was given a set of cards to use as a visual prompt. Participants were asked to consider the strategies and identify which they believed would motivate them personally, and then subsequently, which strategies they believed would motivate Māori people more generally. Findings relating to persuasive strategy preferences are presented in *Chapter Six*. The researcher also created a set of concept cards (see Figure

5.3) to assist in the explanation of the game-design mechanics previously discussed in *Section 2.2.2: Gamification Design Elements*. As with the persuasive strategy cards, the titles were translated from English, and the concept descriptions remain in English. A summary table of the titles, translations and descriptions for all cards follows in Table 5.5.

Figure 5.3

Game-design mechanics concept cards

Game mechanics cards were used as visual prompts to encourage participants to brainstorm and discuss different ideas about how the mechanics could be combined to support each of their preferred strategies. Each hui used different methods to capture this data, some preferred to use whiteboards, and others preferred to use post-it notes. The ideation stage of the hui was led by the participants, with the researcher asking for examples of instances or applications where participants may have seen an idea being used previously.

Table 5.5

Summary of game-mechanics card descriptions

Concept Title (Te Reo)	Concept Title (English)	Concept descriptor rewritten into everyday language
Māka	Points	A unit of scoring awarded for success or performance. A player's points can be accumulated
Tohu	Badges	A badge is a sign which reveals or identifies a special quality or achievement for each player
Papa tātai	Leaderboards	A scoreboard shows the names and current scores of the leading competitors
Kōeke	Levels	Each of a series of stages of increasing difficulty through which a player may progress, completing each stage sequentially to reach the next
Wero	Challenges/Quests	A mission followed by a game player to accomplish a prescribed task
Whakatutukitanga	Achievements	A task completed successfully with effort, skill, or courage
Kohikohinga	Collection	To find / acquire individual items of to complete a set
Whakatauranga	Ratings	A player-based ranking system based on a comparative assessment of quality, standard, or performance.
Pakiwaitara	Narrative Context	A story theme upon which a game is built
Whakatangata	Avatars	An icon or figure representing a person in a video game

Modified from (Orji, Nacke, et al., 2017)

Although it could be argued that providing participants with pre-determined strategies and mechanics constrained them to only consider these constructs, participants were free to discuss any other app design ideas they felt were relevant. The value in this data is around the ideas that participants shared and how they described how a mechanic-strategy combination motivated them both individually and collectively. Each hui lasted between two and three hours, and this provided a wealth of data. In addition to the digital recordings of participant discussion, I wrote field notes during and immediately following each hui. These consisted of observations of the data collection hui and descriptions of artefacts such as photographs and worksheets as well as post-it notes created by participants individually and collectively.

The technique used to generate ideas was a form of adaptive brainstorming, a technique that allows people to ideate based on a visual cue. The benefit of this technique is that, by this point, participants were comfortable with the persuasive strategy concepts and were using their own lived experiences to talk about what they had seen in the past that they thought might work. In two separate hui (19/285 and 19/310), participants selected each persuasive strategy in turn and generated ideas on post-it notes as quickly

as possible, then these ideas were discussed further. During the discussion, participants were asked for examples, or applications where they had seen that combination before. The discussion also sought ideas regarding what they liked or did not like about their experiences. In hui 19/109, one participant voiced that the process was too hard, so the participants appointed a scribe, and that person wrote down their ideas on a white board. In this instance, photographs of the whiteboard data were kept for later analysis.

5.9 DATA ANALYSIS STRATEGY

Kaupapa Māori utilises a wide range of data analysis strategies, without *prescribing* any specific techniques. Rather, the strategy adopted depends on the purpose of the study, the research questions, and the nature of the data collected. Phase One of the current research is qualitative, and as such, knowledge will be derived from discussions with Māori people about their experiences. Creswell (2014) locates this approach as a form of phenomenology in which the experiences of participants are crucial to describing the essence of the phenomena (gamification). It is acknowledged multiple data analysis techniques may be suitable: Grounded Theory; Thematic Analysis; Discourse Analysis; Phenomenological Approaches; or Content Analysis (Rangahau, 2022). Thematic Analysis was selected, due to its precedented use in Māori health intervention research. One study that assumed a Kaupapa Māori philosophical approach and co-designed a Māori health intervention, has been undertaken to date (Te Morenga et al., 2018; Verbiest et al., 2018); This study also employed thematic analysis as a data analysis strategy.

5.9.1 THEMATIC ANALYSIS OVERVIEW

This section will discuss why thematic analysis was adopted for this study, and why the *Codebook* version described by Braun and Clarke (2006) was deemed most suitable. Braun and Clarke (2006) propose thematic analysis as an umbrella term for the key technique used to analyse qualitative data and identify themes within it. Furthermore, they stated that there are three broad schools of thematic analysis: Coding reliability; reflexive; and structured codebook (Braun et al., 2019; Clarke, 2019). Table 5.6 summarises the main differences between each of these variants.

Data collected in Phase One of this study is unstructured and challenging as it contains text in the form of verbatim transcripts, in addition to handwritten field notes, photographs, and hand-drawn worksheets. The researcher's role during data analysis is to make sense of the data, and to provide some coherence and structure to it, while maintaining the integrity of the participants accounts, and still ensure the data can be analysed and interpreted to

address the research questions (Ritchie & Spencer, 2002). Marshall and Rossman (1999) stated that data analysis is the process of "...bringing order, structure and interpretation to the mass of collected data", and furthermore, that "it is the search for general statements about relationships among categories of data" (p. 150).

Table 5.6

Comparisons of three schools of thematic analysis

Broad TA Type:	**Coding Reliability**	**Reflexive**	**Codebook**
Key Proponents	Boyatzis (1998); Guest et al. (2011); Joffe (2011)	Braun and Clarke (2006); Braun et al. (2019); Clarke and Braun (2017)	Brooks et al. (2015); Miles and Huberman (1994); Ritchie and Spencer (1994)
Philosophical characteristic	Partially qualitative: qualitative data analysis within a quantitative orientation	Qualitative orientation Not inherently realist	Qualitative data analysis
Approach:	Deductive Theory driven Top-down	Inductive Data driven Bottom-up Subjective Interpretive	Deductive/ theory driven OR Inductive /data driven
Process	Familiarisation ↓ Theme development ↓ Coding framework ↓ Test reliability	Immersive familiarisation ↓ Organic coding ↓ Theme development	Familiarisation ↓ Theme development ↓ Coding ↓ Theme refinement
Reliability	Coding reliability Replicability Multiple independent coders Calculating inter-coder reliability Coder consensus	Single coder Reliability is ensured through transparency	Replicability of observation Transparency
Theme development characteristics	Domain summaries derived from data questions Theme as analytic input for coding	Themes conceptualised as meaning-based: Semantic (explicit) or latent (conceptual) Theme as output of coding	Domain summaries derived from data questions Theme as analytic input for coding Themes can be further refined through coding

5.9.2 CODING RELIABILITY THEMATIC ANALYSIS

Coding reliability thematic analysis (CRTA) is characterised by Braun et al. (2019) as a partially qualitative approach. Key proponents Boyatzis (1998), Guest et al. (2011); and Joffe (2011) suggest that CRTA is a bridge between qualitative and quantitative methods,

and that the data analysis process is a qualitative approach to qualitative data, but the underlying philosophies are "firmly (post-)positivist" (Braun et al., 2019, p. 847). Researchers adopting CRTA are concerned with reliability and replicability of findings, indicating a desire to demonstrate coding reliability (Clarke, 2019).

The CRTA school is commonly deductive (Boyatzis, 1998) as the researcher begins with a theory, and this theory will influence the development of themes prior to the coding process (Clarke, 2019). Themes pre-exist in the data and the role of the researcher is to find them (Boyatzis, 1998). Themes are conceptualised as domain summaries that have commonly been derived from the research and data collection questions. Preferably, these determined themes are *applied* to the data by multiple, independent coders. After coding, inter-coder reliability is calculated, and discrepancies are resolved through discussion until a consensus is achieved (Braun et al., 2019).

5.9.3 REFLEXIVE THEMATIC ANALYSIS

The reflexive thematic analysis (RTA) approach, as conceptualised by Braun and Clarke (2006), is a "*fully* qualitative approach" (Braun et al., 2019, p. 848), this means that the underpinning assumptions behind the research philosophies suggest that qualitative data collection, analysis and worldviews are subjective or interpretive in nature.

In RTA, code development is organic and evolves throughout the iterative coding process (Braun et al., 2019). It is an inductive, bottom-up approach in the sense that coding is driven by the data and not by a predetermined *codebook*. The aim of coding is to "provide a coherent and compelling interpretation of the data, grounded in the data" (Braun et al., 2019, p. 848). The theme development and coding process begins with a thorough *intense immersion* in the data (Clarke, 2019). Codes, and subsequently themes, represent considerable analytic work (Clarke, 2019). Themes are conceptualised and actively created to demonstrate an understanding of "patterned meaning across the data set" (Braun et al., 2019, p. 848).

Themes are usually developed in one of two ways; either explicitly (semantic) or conceptually (latent) (Braun et al., 2019), depending on whether the researcher has a particular area of interest within the data such as specific research questions (as in semantic); or to explore underlying concepts within the data (as in latent) (Braun & Clarke, 2006). A single coder is entirely appropriate within the RTA approach as coding is subjective by nature and multiple coders will not stop the reflexive coding process from being subjective (Braun & Clarke, 2006). The reflexive school is not specifically

concerned with coding reliability or replicability, rather, it is concerned more with transparency and describing the researcher's philosophical assumptions (Braun & Clarke, 2006).

5.9.4 CODEBOOK THEMATIC ANALYSIS

Codebook thematic analysis (CTA) encompasses several different approaches, such as *framework analysis* (Ritchie & Spencer, 1994), *template analysis* (Brooks et al., 2015), and *matrix analysis* (Miles & Huberman, 1994). According to Braun et al. (2019), CTA approaches share certain characteristics with both coding reliability, and reflexive thematic analysis in that they share the structure of CRTA and the qualitative philosophy of RTA. One strength of CTA is the structural approach that benefits novice researchers to apply theoretical or derived codes to any text-based data (Braun et al., 2019). Code structures may be defined before data is collected, or before data analysis begins and these structured codes are then *applied* to the data (Clarke, 2019). Typically, some themes are developed early on, or they may be pre-determined or derived from theoretical frameworks. However, as in the case of RTA, the codebook framework offers more flexibility than CRTA in that themes may be further refined throughout the coding process (Clarke, 2019). Some researchers suggest that conventions for the various thematic analysis schemes are flexible and interchangeable (Brooks et al., 2015). However, Braun et al. (2019) agree that researchers should adopt the thematic analysis approach that will result in the most cohesive piece of work, but also stated that "pragmatic factors should not (always) be the sole determinant of method" (p. 7).

5.9.5 CHOOSING THE CODEBOOK APPROACH FOR DATA ANALYSIS

This subsection justifies why the codebook thematic analysis (CTA) technique was deemed the most appropriate data analysis strategy for this research. In codebook thematic analysis, the use of a coding framework is "oriented to pragmatic considerations such as meeting predetermined information needs" (Braun & Clarke, 2021, p. 5). One challenge within the current research is to reconcile a largely Western data analysis strategy with Kaupapa Māori (Māori approach). The informational needs identified for this study include understanding a unique context, which allow the researcher to address the research gap and provide answers to the research questions as outlined in *Chapter Three*: *Research Gap and Questions*. It is this quest for understanding the Māori context that drives the codebook approach. Coding decisions were based on developing an understanding of what makes the Māori context unique, and how the participants' discussions address the

research questions, which are also Māori-centric. This top-down approach differs from other forms of data analysis such as reflexive thematic analysis which is more organic in nature in the sense that coding is driven by the data and not by a predetermined codebook.

As discussed in *Section 2.4.5: Reasoned Action Approach*, this study uses a modified RAA model to understand the contextual factors, beliefs, and attitudes towards gamification in health behaviour change, specifically within a Māori context. As the research is driven by health behaviour change theories and motivational theories, it makes sense to apply predefined constructs to the data to determine how the RAA model explains attitudes, perceived norms, and the impact of these on behavioural intentions. Perceived norms are an important aspect of Indigenous research, and can explain differences in technology acceptance, use and behavioural intentions. Normative beliefs have a significant impact on an individual's motivation to comply, a dimension that the literature indicates may be important in Indigenous communities. Constructs of gamification including persuasive strategies and game design elements were derived from the literature and explained in *Chapter Two: Literature Review*; data will also be coded for explicit instances of these concepts. This allows the researcher to specifically address research questions relating to the perceived effectiveness of persuasive strategy and game design element combinations.

As the research questions presented and discussed in *Chapter Three: Research Gap and Questions* are derived from theoretical models and frameworks, it makes sense to apply a theoretical coding framework to the data. The framework approach adopted for the current research was comprehensively described in Braun et al. (2019) and Braun and Clarke (2021). Codebook thematic analysis is a process of five key interconnected stages described by Ritchie and Spencer (1994, 2002), and is presented in the next section.

5.9.6 CODEBOOK THEMATIC ANALYSIS PROCESS FOLLOWED

This subsection will discuss how the researcher adapted the codebook thematic analysis approach described by Ritchie and Spencer (1994, 2002). Table 5.7 identifies five stages of codebook thematic analysis and their descriptors. The third column summarises the activities undertaken in this study. Each stage of the data analysis process and activities will be described and explained in this section.

Table 5.7

Stages of Codebook Thematic Analysis

Phase	Description of the process	Activities in this study
Data familiarisation	Immersion in the data Listen to recordings Transcribing data (if necessary) Reading and re-reading texts	Recorded hui Wrote fieldnotes during/after hui Transcribed data / made initial notes Re-read transcripts
Identifying a thematic framework	Identify key issues, concepts, and themes Refer to a priori issues Emergent issues raised by participants Analytical themes	Imported text into NVIVO Formulated a codebook framework • a priori issues • theoretical constructs • researcher notes • emergent issues Review codebook
Indexing	Framework is applied to data Annotations made Interpret excerpts	Reviewed each text passage Applied framework Made additional notes
Charting	Data rearranged according to thematic reference Charts constructed for each group of respondents	Sorted data using NVIVO
Mapping and interpretation	Identify key characteristics of the data Map the dataset as a whole Define concepts Identify associations Provide explanations	Identified connections between themes Developed theme hierarchy map Wrote theme summaries Defined each theme

Compiled from Ritchie and Spencer (1994, 2002)

5.9.6.1 DATA FAMILIARISATION

Thematic analysis researchers describe the familiarisation phase as immersive (Braun & Clarke, 2006; Ritchie & Spencer, 2002), meaning the researcher should have an in-depth understanding of the content of the data. Immersion involves multiple readings of the data in an "*active* way" (Braun & Clarke, 2006, p. 87) while searching for meaning. Familiarisation activities will also include listening to recordings and studying field or observation notes (Ritchie & Spencer, 2002).

Data analysis in this study began immediately following each data collection cycle. Following each hui, I transcribed the hui discussion verbatim from the audio recordings, paying attention that my punctuation and emphasis accurately depicted the original meaning of the verbal account. I listened to the audio recordings multiple times and read the transcripts on multiple occasions. The transcription process informs the early stages of the data analysis, and I made additional notes and captured notes of recurring themes.

5.9.6.2 IDENTIFYING A THEMATIC FRAMEWORK

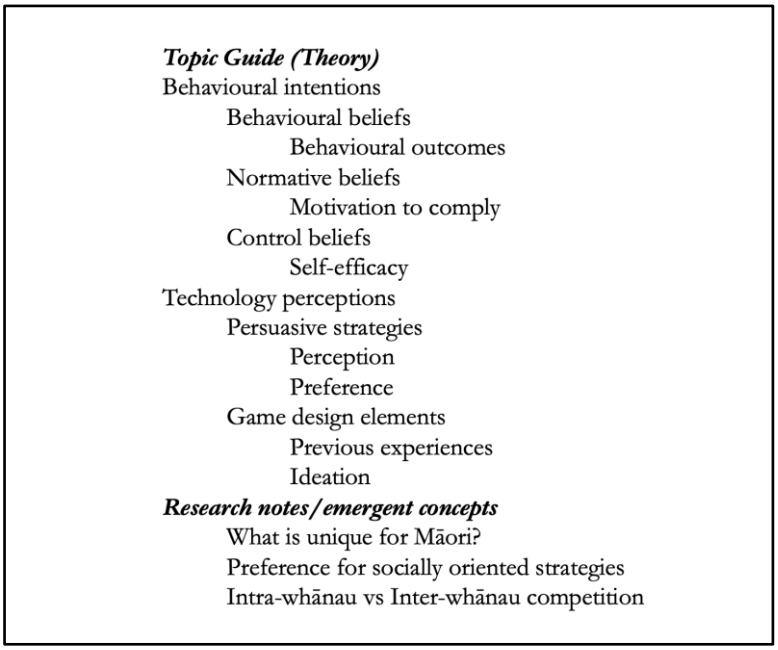
During the familiarisation phase, the researcher is not only gaining an in-depth understanding of the data, but also forming perceptions about the thematic concepts contained within it (Ritchie & Spencer, 2002). Observations and notes made during the familiarisation phase help inform key issues, concepts and themes in the data, and these form the basis of the thematic framework that will be used to sort the data.

Ritchie and Spencer (2002) also stated that constructs from the original research aims and research questions will inform the thematic framework. Furthermore, emergent issues raised by research participants and recurring themes or data patterns also inform the framework. The first version of the framework is typically based on a priori issues such as those relating to the literature or theoretical models. Ritchie and Spencer (2002) suggest applying the framework to a few transcripts and modifying it in relation to emergent and analytical themes. Although this sounds like a mechanical process, Ritchie and Spencer (2002) argue that it requires "both logical and intuitive thinking" (p. 10), with the researcher interpreting meaning, relevance, and importance of issues.

Following the transcription, I imported the text file into NVIVO and once again read the transcripts in preparation for identifying key themes. I formulated a framework which is derived from the research questions, theoretical constructs, and initial notes made about emergent themes in the familiarisation phase. This framework is illustrated in Figure 5.4.

Figure 5.4

Thematic framework



Original work

In this study, each hui was transcribed, and the framework was reviewed and extended prior to beginning the next hui data collection if new themes were identified. The reason for this was that there were several research questions developed for this study and I felt it was important to be sure I had a good understanding of the issues and factors, and to ensure that I could focus on exploring the experiences and contextual issues experienced by the participants. It could be argued that each hui informed the direction for questioning in the subsequent hui, as the line of discussion evolved with the data analysis. This deviates from the process outlined in Ritchie and Spencer (2002) who suggest that a thematic framework is generated across the whole dataset.

5.9.6.3 INDEXING

The process of systematically applying the thematic framework (also referred to as an index) to the individual transcripts is called *indexing*. Typically, a researcher considers each passage in the text and infers its meaning (Ritchie & Spencer, 2002). Passages in the text may contain multiple themes, and the researcher indexes (records) each theme from an implicit and explicit perspective. Thematic analysts agree that interpreting meaning is subjective and may be open to multiple interpretations (Braun & Clarke, 2006; Clarke, 2019; Ritchie & Spencer, 2002). However, the indexing process requires the analyst to make annotations in the data to make the process "visible and accessible" to others (Ritchie & Spencer, 2002, p. 14). The process followed in this research does deviate slightly from the process described by Ritchie and Spencer (2002) in that instead of recording themes in the margins of printed texts, this process was completed using NVIVO software, but the manual process is demonstrated in Figure 5.5.

Figure 5.5

Indexing example

> **RESEARCHER** How do you think that technology can help motivate you to take a healthier perspective on your life, so being more active and eating better?
>
> **19/285#2** I just realised that it could if you introduce this to the whole family [12]. Because if it's an application that everyone can get on their phone [5,6] and you put up a little group with the family [11,12] in it. And then you have your goals [1] and the brothers and sisters have a little rivalry [3,4,7,8]. And they try to compete against each other [10] but it motivates the other people in the family [3,4], because that's a big thing within our whole, our schools, all around [3,4,9]. It's mainly this rivalry between families [9] that usually motivate us to do better [3,4] especially like kapahaka and stuff [11]. Try to out haka each other [3,4,9,11], in all these things in between those breaks it usually competitive [8]. It's like fun [8] but like the main goal [1] was to beat the person [9] and that really motivated everyone [2], even the little kids [3], to try their best [3,4].

This extract is from the first hui and is particularly rich with themes. I considered each section of text in the transcript and applied the preliminary framework to the text. In this example, the themes from the framework are numbered, and listed below:

1	Behavioural intentions	7	Persuasive strategy perceptions
2	Behavioural beliefs	8	Persuasive strategy preferences
3	Normative beliefs	9	inter-whānau rivalry (external)
4	Motivation to comply	10	intra-whānau rivalry (internal)
5	Control beliefs	11	What is unique for Māori
6	Technology beliefs	12	Collective-thinking

This example shows that text passages can contain multiple themes, and it is common across the entire dataset that themes were both interwoven, and highly interconnected.

5.9.6.4 CHARTING

Ritchie and Spencer (2002) describe the process of *charting* as uplifting data from the original context and rearranging it in relation to each theme. They further suggest that charts may be sorted according to theme or to respondent. The process described in Ritchie and Spencer (2002) involves ordering and grouping extracts by case, always ensuring the cases were kept in the same order across each chart. Technology has advanced significantly in the two decades since this process was described, and today

applications such as NVIVO make it simple to view a single thematic construct and see all extracts relating to this theme. Additionally, these can be sorted by individual participant or by individual hui to identify whether themes were discussed more robustly within a group or equally across the dataset.

5.9.6.5 MAPPING AND INTERPRETATION

The final phase described by Ritchie and Spencer (2002) is *mapping and interpretation*. The process typically begins with reviewing the charts and research notes made during each of the previous phases. The researcher compares the abstracts, searching for patterns and connections within the data. Rather than being a mechanical process, it is immersive and subjective; it requires the researcher to consider the dynamics and interrelationships between issues and to search for a structural way to make sense of the entire dataset.

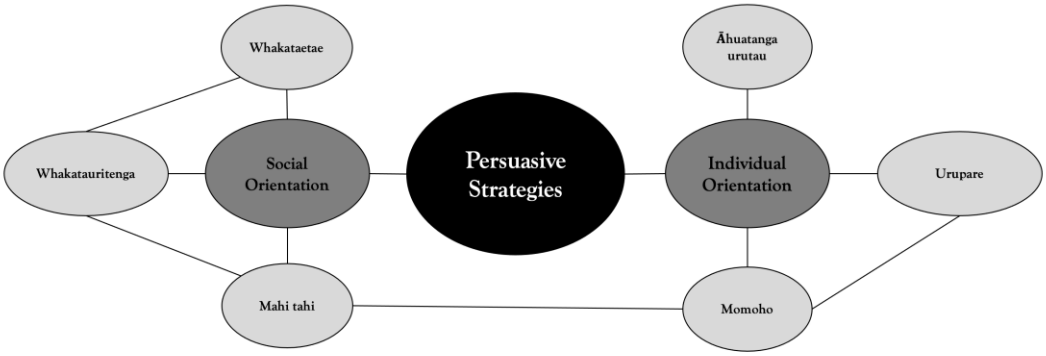
Describing the specific process followed presents a challenge for researchers as there are multiple approaches that could be adopted. Ritchie and Spencer (2002) describe several approaches to mapping and interpreting the data that are relevant in this study: identifying associations; mapping themes; defining themes. Each of these approaches will be described, then followed by an example of how it was implemented in this research.

Identifying associations: While indexing and charting the transcripts the researcher becomes aware of certain patterns or associations within the data, and these patterns may be made explicitly by participants, or derived from implicit connections. The connections between themes or notions are observed by the researcher based on their immersion in the data, but also informed by a priori issues. This was also the case in this research.

One example that emerged from data analysis is the notion that there appears to be a relationship between the persuasive strategies identified in the literature, and whether an individual held a social orientation, or an individual orientation. During this final phase of data analysis, I attempted to visualise these connections using mind maps. An example of one visualisation is illustrated in Figure 5.6.

Figure 5.6

Relationships between persuasive strategies and social orientation



Original work

Mapping themes: In this study, I considered each of the themes identified for the framework and determined the links and relationships between each theme. Some new themes were identified during the indexing phase and the framework itself was revised and extended on multiple occasions. During the charting phase, I considered the hierarchy of themes, and made decisions about how the themes intersected. Finally, I developed a hierarchical mapping structure that showed the final themes and subthemes that will be discussed in *Chapter Six: Findings*. The final themes are shown below to demonstrate this process:

1. **Māori Social context:**
   Whānau expectations
   For the benefit of all
   Knowledge sharing
2. **Underlying beliefs:**
   Outcome beliefs
   Control beliefs
   Motivation
3. **Persuasive strategies:**
   Separate strategies
4. **Game design elements:**
   Separate elements

Defining themes: Ritchie and Spencer (2002) briefly describe their process for defining concepts, but this does little to explain what should be done. However, Braun and Clarke (2006) recommend explaining the *essence* of the theme and to describe what

each theme is about, but more importantly, to describe how each of the themes and subthemes fit together to tell a cohesive *story*.

To define each theme, I wrote summary explaining how the theme is constructed, and why it was important. I also described how each of the sub-themes fit together to tell a broader story while still addressing the research questions. These theme descriptions are included in *Chapter Six* and are used to explain and introduce each theme and subtheme. For brevity, they will not be repeated here. This subsection has explained how the Codebook thematic analysis approach was adopted for this study. It has explained the process followed and given examples from the data analysis process to illustrate each stage.

5.10 ETHICAL CONSIDERATIONS

Prior to participant selection or data collection, the researcher had obtained ethics approval from the *University of Waikato Ethics Committee (Health)*: UoW HREC(Health) #2018-19. Copies of the ethics approval and the participant information, consent, and demographics data sheets are appended to this study: See *Appendix B – Participant Information Sheet; Appendix C – Participant Consent Form; Appendix D – Participant Demographic Form; and Appendix E – Ethical Approval.*

Prior to beginning data collection, permission was sought from each participant to audio and photographically record the hui. Photographs were cropped to protect each participant's identity. Participants were reminded that they had the right to withdraw from the research at any time and were advised that at no time will the recorded data be attributable to an individual is a way that might identify them publicly. Participants details have been anonymised, and original transcripts and identifiable data are stored in a password-protected file that can only be accessed by the researcher. There were no requests from participants to be removed from this study, although two participants declined to be contacted for additional phases.

5.11 CHAPTER SUMMARY

The purpose of this chapter has been to explain the research design for Phase One of this study. It began by explaining how the Kaupapa Māori methodology reconciles with a Design Science Research. This first section explained that *problem-solving* IS research begins with *problem-understanding* and outlined the process that will be followed to produce problem-solving artefacts while following culturally respectful methods.

The primary data collection strategy in this phase is a series of co-design hui which are Māori-led focus groups that ask Māori people to discuss their experiences with technologies, and to brainstorm how to design an application to support healthy lifestyles for Māori. This chapter has also presented various thematic analysis schools and explained why the codebook thematic analysis approach is most appropriate.

Finally, this chapter has discussed the participant selection strategy, and justified why it is appropriate that all participants in this research identify as Māori. This phase of the study has ethical approval from the *University of Waikato Ethics Committee (Health)*: UoW HREC(Health) #2018-19, and the chapter concludes with explaining some of the steps taken to ensure this research meets a high ethical standard.

CHAPTER SIX: PHASE ONE FINDINGS

This chapter presents the findings of *Phase One: Co-Design Hui*. It uses codebook thematic analysis techniques for developing these themes, and follows the process explained in *Chapter Five: Research Design*. Discussion of these findings takes place in *Chapter Seven*. After completing the data analysis process described in *Section 5.9.6: Codebook Thematic Analysis Process Followed*, five themes were developed. A summary of these five themes is shown in Table 6.1; this table also presents a description of each theme. Each of these themes is presented in the following subsections, and their relationship to the research questions is also presented.

Table 6.1

Summary of themes

Research Question	Theme	Description	Section
RQ1	*Social context for Māori*	In Māori society, whānau (family) have a strong impact on an individual's behaviour. The expectations of referents directly impact an individual's motivation to comply with a specific behaviour. This theme explores factors such as collective-thinking and a generosity mindset.	6.1
RQ2	*Underlying beliefs*	The perceptions an individual has toward a health behaviour change technology and to making healthy lifestyle decisions impacts their attitude toward undertaking activities that support these outcomes. This theme explores individual's perceptions about self-efficacy and their ability to overcome barriers for adopting a technology.	6.2
	Persuasive strategies	Persuasive strategies are frequently found in information technologies such as mobile applications and computer software, and as such, may be considered motivating factors of engagement and continued use intentions for any software.	6.3
RQ3	*Game design elements*	Game design elements essentially breaks computer-games down to a fundamental level and explores each of these elements individually to consider how each element is interpreted and valued by participants	6.4
	Matching strategies with mechanics	The interpretation of how participants perceive how game design elements combinations may be efficacious in supporting the previously identified persuasive strategies	6.5

6.1 RESEARCH QUESTION 1:

The first research question in this study is*: What are the key contextual elements that shape Māori engagement in health behaviour change?* The aim of RQ1 is to explore the unique context of Māori health through examining the normative beliefs, attitudes, perceptions, and behavioural intentions of participants. Understanding the belief system of Māori participants will guide the development of an intervention that encourages Māori users to become more physically active and to make healthy food choices. Previous research has shown that the perceived beliefs of referents significantly impact an individual's decision-making process. Therefore, this research question also seeks to explain the impact of peer pressure on behavioural outcomes.

6.1.1 THEME ONE: MĀORI SOCIAL CONTEXT

This theme explains how the Māori social context is unique, specifically, it explains that in Māori society, whānau (family) have a strong impact on an individual's behaviour, particularly as it relates to perceived expectations and their impact on motivation to comply with those expectations. The theories of reasoned action and planned behaviour state that normative beliefs such as the expectations of referents, have a direct impact on an individual's motivation to comply with the perceived expectations, and this is also true in Māori society.

Table 6.2 summarises each of the subthemes and conceptual ideas for Theme One: Māori Social Context. The first subtheme, *whānau expectations* shows that Māori tend to act in ways that prioritise whānau, such as committing to a healthy lifestyle change as a group rather than individually. Participants in this study suggested that some Māori have a collective-thinking orientation which manifests through a sharing and generosity mindset as demonstrated in subthemes *for the benefit of all*, and in *knowledge sharing*. This study suggests that these qualities may be distinct Māori attributes.

Table 6.2

Development of Theme One: Māori social context

Final Theme	Subthemes	Conceptual ideas	Exemplar extract
Māori social context	*Whānau expectations*	Perceived expectations of friends and whānau have a significant influence on an individual's behaviour.	*"I think we won't achieve it if we do it by ourselves" (19/310#1)*
	For the benefit of all	Perception that behavioural intention changes when whānau members are the beneficiary of such a behaviour.	*"We have 'hei painga mo te katoa' which means we do it for the benefit of everyone." (19/310#4)*
	Knowledge sharing	Knowledge sharing is another dimension of collectivism that explores the generosity mind-set of Māori.	*"I think community is where it starts cause then it will pass on to the next community, to the next family which will share with their community." (19/310#1*

6.1.1.1 WHĀNAU EXPECTATIONS

This study finds that the perceived expectations of friends and whānau (family) have a significant influence on an individual's willingness to begin a health behaviour-change programme, and whānau expectations seriously impact an individual's motivation to comply with a health behaviour-change programme. This subtheme explores the relationship between normative beliefs and an individual's motivation to comply with health behaviour change.

In Māori society, whānau are familial groups of people who are related to each other, usually within one or two generations. They share either blood, kin, or a close primary relationship. Whānau relationships underpin Māori social identity and are an important source of normative influence. This study finds that the perceived expectations of whānau has an impact on whether an individual is likely to perform a health-related behaviour. Participants discuss that the expectations of their whānau can hold them accountable for adhering to their decision to begin a healthy lifestyle change. An example is shown in the following extract. During a discussion on accountability, the following participant is responding to a follow-up question about whānau accountability:

> *"So, everyone can see how you're doing … sort of more, [like] peer pressure. […] One of the best things I've ever heard is that the best exercise to undertake is the one that*

you will get up and do. It really doesn't matter exactly what it is, as long as you do it. Which is the same for smartphone apps, if you're not really going to do it then... unless you're going to use peer pressure [to get people] to do it." (19/109#4)

Multiple participants discussed the idea of peer pressure as a driver of motivation and that being accountable to self, or to others is a strong motivational force toward continuing a health behaviour change journey.

Participants discuss that the perceived expectations of whānau have a positive impact on their behaviour and that they share their behavioural intentions to leverage whānau accountability motivation. Moreover, there were participants who felt that a lack of whānau accountability would be demotivating. In the following extract the participant is specifically talking about the need for accountability when using an exercise application. In this example she is discussing the role of accountability in motivating her near-adult children to be more physically active:

"I'm already active anyway, it's a mindset for me […], I motivate my kids, right up to a twenty-year-old. At the end of the day, they require me to motivate them, they won't do it by themselves. So, if I [had] an app on the phone… At the end of the day no one's gonna look at the app and say 'oh you did your exercises today' right? So, there's no accountability, there's no motivation to want to do it." (19/109#1)

This extract illustrates that whānau accountability is an important aspect of health behaviour change and that for some people, a lack of accountability options within an app design may lead to a decrease in motivation to adhere to a behaviour change programme. Accountability has a positive impact on motivation firstly from the perspective that being accountable to friends and whānau can lead to exercise programme adherence, and secondly, it is a form of social pressure that can be applied to compel people to comply with a behaviour change programme.

The concept of *external accountability* in the context of this study differs from social accountability as it extends to service providers such as exercise prescribers. There is a perception that when an influential referent, in this case a personal trainer hired by the participant, can view the activity behaviour through tracking reports, then this will motivate users to comply. The following participant is suggesting that without an authority overseeing her compliance, she will likely not perform the desired behaviour but tell other people that she did:

"… it shows your intensity on your app, and it shares it with other people so your trainer can see if you're actually going to the gym. It just keeps you accountable. For me it's accountability because I can go 'yeah I went' [to the gym today], but I didn't go." (19/310#1)

In some ways, this extract is very similar to the previous statement where the participant said that without accountability, there was no motivation to exercise. In that case, the participant was discussing peer pressure and its effect on programme adherence. In this case however, the participant is talking about compliance which suggests that the perceived expectations of health professionals enforce a degree of compulsion as the person to whom she is accountable has directed the exercise programme.

This sub-section has discussed the perceived expectations of people who are important to an individual, and how these impact an individual's motivation to comply with behaviour change. Another interesting aspect of Māori social context is closely related to whānau influence: it describes the importance of familial relationships, showing that people are more motivated to make positive health behaviour changes when other members of the whānau are also undertaking a desired behaviour.

6.1.1.2 FOR THE BENEFIT OF ALL

The previous subtheme explored participants perceptions of the expectations of referents, and the impact of these perceptions on the individual's motivation to comply with health behaviour change. This subtheme explores the participants' beliefs about including friends and whānau in the behaviour change journey. Participants reported that they are more willing to adopt behaviour change with the support of whānau and when household members are involved, such as all family members undertaking hiahia hāere ki te hauora (a journey to health), together. Similarly, this study also finds that some Māori may be more motivated to undertake a behaviour change programme when they perceive that whānau members are the beneficiary of such a behaviour, this illustrates that social support may be an important aspect of engagement with health interventions for Māori. Participants stressed that whānau involvement is important, and some participants believe that everyone within the household needs to be in the programme for success:

"Yeah, I think doing it as a family because […] I think we won't achieve it if we do it by ourselves. Because if say for example if we're trying to eat healthy, if I'm trying to be healthy and the rest aren't, I'll fall back off easily because it's easier to eat what they're having than to cook my own and to smell their food." (19/310#1)

This extract shows that people consider whānau support is important to their own success. Participant 19/310#1 shows that she believes other people in the whānau also making a behaviour change would make it easier for everyone to adhere to a healthy lifestyle.

A recurring idea throughout the hui was that some Māori have a sense of being a collective and working together. The concept of collective thinking embodies the idea that some Māori work together for the benefit of the collective, rather than the individual person. This was a common theme across the whole dataset, and is a topic that participants were very keen to discuss. The participant in the following extract is explaining the importance of community to Māori, which may be an important design consideration for encouraging Māori to engage with healthy behaviours:

> *"Our community is important, eh? We have this thing, it's… We have 'hei painga mo te katoa', which means we do it for the benefit of everyone. It's not just about me, me, me, at least not where I come from. Does that make sense?" (19/310#4)*

There appears to be a sense that some Māori individuals will perform a behaviour they are reluctant to adopt when they perceive that other people within the wider whānau will benefit from the action. This is important within the context of health behaviour change because an individual might not be motivated to undertake a health behaviour change for themselves, yet they may be motivated if they perceive that other members of the whānau will benefit from the behaviour. This has a significant impact on design as this tendency could be leveraged by keeping whānau groups central to the goals and activities in a health application. There are examples of recent health communication targeting Māori such as one media campaign encouraging women to have mammograms, by suggesting they should do it for their mokopuna [grandchildren] (Breast Cancer Foundation New Zealand, 2020).

Participants in this study suggested that Māori may prefer to work cooperatively to achieve group goals particularly when the group members are known to each other:

> *"It's good if you were doing this as a group because you were supporting each other" (19/109#1)*

In this extract the participant is specifically discussing Mahi Tahi (working together) with whānau to complete group wero (challenge). Competition and cooperation are discussed in *Section 6.2.2: Theme Three: Persuasive Strategies,* but it is interesting to note from a design perspective that a potential application might encompass attributes for both cooperation and competition. To facilitate this idea, one participant suggested that giving users the

option to choose an iwi group during the onboarding process would support both iwi-vs-iwi competition and intra-whānau cooperation:

> *"What about if you had an app that when you sign up to it, you align yourself to your iwi, and then you have iwi challenges, iwi against iwi?" (19/285#3)*

This idea is important because it demonstrates that an application that leverages a collectivist perspective may encourage Māori users to adopt and continue use of the technology. Participants self-identifying with a collectivist perspective was common across all hui and was discussed with fervour by multiple participants. In one sense, participants expressed that a collectivist perspective is unique to Māori identity as is demonstrated in the following extract:

> *"What I'd say is probably confusing about that or to you, correct me if I'm wrong, is that as we hear people talking, that as Māori, we have a sense of identity and a sense of collectiveness and if one person stuffs up, regardless of where they're from, right? If you've got a young Māori boy and he stuffs up then you feel an obligation to apologise on their behalf. Same thing goes if they do something good, right? You feel proud in their successes, being Māori yourself. What you're probably struggling to conceptualise, is how you can feel proud and how you can feel as though that Māori boy is one of yours, but also, how we can also just compete against Māori as well, in our own little groups." (19/109#5)*

Participant 19/109#5 is explaining that in their personal experience the sense of *collectiveness* encompasses a sense of responsibility for other Māori. Yet this extract also highlights that some Māori also experience a sense of *competitiveness*, and this appears to contradict the sense of collectiveness or preference for a cooperative approach. The tension between competition and cooperation is important in this study and findings relating to this relationship are presented in *Section 6.2.2: Theme Three: Persuasive Strategies*.

This subtheme has explored the participants' beliefs about including friends and whānau in their behaviour change journey and undertaking a behaviour change programme collectively. This subtheme has highlighted that participants are more willing to adopt behaviour change with the support of whānau and when whānau members are involved and when whānau members benefit directly from the behavioural outcomes. One dimension of collective thinking that is not explored in this subtheme is the idea that sharing knowledge is an integral aspect of Māori society.

6.1.1.3 KNOWLEDGE SHARING

Knowledge sharing is another dimension of collectivism that explores the generosity mind-set of Māori. This study finds that some Māori have an inherent willingness to share information, knowledge and resources with their wider community. In this study there was no sense that people would take advantage of information for themselves; rather, the overriding drive was to share information with other people. The type of information that is relevant in the context of this study includes where seasonal fruits and vegetables can be obtained, and where they were available at the lowest price. Participants also felt that information sharing by users within an application would be a valuable design feature. In two separate hui, participants discussed the value of a smartphone application called *Gaspy* that allows users to upload the current price of fuel products in their area for the benefit of all users.

In the following extract the participant is explaining that sharing information about the location of cheap fruit and vegetables could support users to make healthy food choices. This is the core idea of *Gaspy*: users of the application contribute to current fuel prices in their area for the collective benefit of all users. The following extract demonstrates a theme of generosity, reciprocity and community-mindedness that is consistent across the whole dataset and appears to be a characteristic common to Māori:

> *"There's an app I have it's called Gaspy, I'm not sure if you've heard of that? It's really good if you want to find out where the cheapest petrol is. I use it every now and then. And so, if you had a similar thing and I don't know if supermarkets would like this, but, where would be the best, cheapest kind of vegetables for the season?" (19/285#1)*

In addition to sharing information about seasonal produce, participants also suggested that information would be relevant to an individual's current location and therefore contextualised to people located within a specific geographic community. Participants recognised that eating seasonally was a healthier option, and therefore being aware of the currently seasonal produce would be beneficial. This is demonstrated in the following extract:

> *"If there was something in the app that gave me a heads up that actually this is in season and you should look towards this, and it's cheaper, then that's cool." (19/285#1)*

Participants discussed that knowledge sharing would ensure key information got to people in an extended community group, and that this was a key driver to knowledge

sharing. Participants discussed that individuals within a whānau group will also have external connections, and therefore the information will likely be shared across multiple networks benefitting the wider community. The concept of community is important, and participants felt that making healthy lifestyles would impact the wider community. This is demonstrated in this extract:

> *"I think community is where it starts cause then it will pass on to the next community, to the next family which will share with their community." (19/310#1)*

The subtheme *knowledge sharing* has demonstrated that some Māori have a generosity mind-set that is reflecting in a willingness to share information that would be beneficial to the wider community. Within the context of a health behaviour change application this might manifest as a user-generated content feature that encourages users to seek and share information that may be valuable to a wide user base.

Theme One: Māori social context has explained several factors that significantly influence Māori society and demonstrated that normative beliefs and the expectations of friends and whānau hold Māori accountable and are a compelling influence on behavioural adoption. Subthemes: *For the benefit of all*, and *Knowledge sharing* show that some Māori may be motivated to comply with healthy behaviours when that behaviour benefits the whānau, such as a whānau-wide commitment to increased physical activity. This study also found that some Māori have a collective-thinking orientation which manifests through a sharing and generosity mindset and that these attributes may be unique within Māori society.

6.2 RESEARCH QUESTION 2

Understanding an individual's underlying beliefs about health behaviour change technologies gives researchers an insight into how to design interactive computing systems to influence the attitudes and behaviours of users. Technologies that employ specific persuasive techniques are growing in popularity in the health domain. However, to date it is not known whether specific persuasive strategies are more effective than others. Findings in this section address this issue specifically, from a Māori perspective. Two themes are presented as a response to the research question: *Which persuasive strategies are effective in gamified physical activity and diet interventions for Māori?*

Theme Two: Underlying beliefs discusses constructs from health behaviour change theory relating to an individual's beliefs about health behaviour change technologies, self-efficacy, and motivation. *Theme Three: Persuasive strategies* are commonly designed into information technologies such as mobile phone applications and computer software to encourage

users to adopt and continue to use the technology. In this theme participants identify which strategies resonate with Māori.

6.2.1 THEME TWO: UNDERLYING BELIEFS

The *Reasoned Action Approach* (RAA) explains that an individual's underlying beliefs and attitude toward a target behaviour, subjective norms, and perceived behavioural control have a direct impact on behavioural intentions (Ajzen, 2012; Fishbein, 2008). Findings relating to subjective norms were presented as *Theme One: Māori social context.*

Theme Two: Underlying beliefs explores three key aspects of behaviour change theory: outcome beliefs, control beliefs, and motivation (see Table 6.3). The core idea is that the perceptions an individual has toward health technologies and to making healthy lifestyle decisions impacts their attitude toward undertaking activities that support these outcomes. Furthermore, this theme explores individual's perceptions about self-efficacy and their ability to overcome barriers for adopting a technology. This theme also considers self-motivation and accountability as motivators of health behaviour change.

Table 6.3

Development of Theme Two: Underlying beliefs and attitudes

Final Theme	Subthemes	Conceptual ideas	Exemplar extract
Underlying beliefs	*Outcome beliefs*	The beliefs an individual has toward using a health technology, and whether they believe the technology would be beneficial to them.	*"…I am saying that a phone would be helpful way of reminding us." (19/109#2)*
	Control beliefs	A reflection that any factors which may facilitate or inhibit the adoption of a health technology are within a participant's control.	*"Access to a device isn't a problem. It's affordability, so there's that, data [cost]" (19/285#1)*
	Motivation	An individual's drive to make behavioural changes.	*"That would be when I'm ready I suppose, my motivation. So, the app doesn't drive me, I drive the app." (19/285#1)*

The theoretical discussions in *Section 2.4: Health Behaviour Change Theories in Gamification,* and the model presented in *Section 2.4.5*: *Reasoned Action Approach*, informed the development of this theme. The adapted RAA model shows that attitudes directly impact behavioural intentions, and attitudes are informed by an individual's belief system. As the guiding questions in the hui supported exploring this theoretical model, it is not surprising that participants' underlying beliefs are found to be a strong theme.

Theme Two does not include normative beliefs for two reasons: firstly, normative beliefs are a concept that stands alone as a theme in this study and was presented as Theme One; and secondly, this study finds that aspects of normative beliefs may be ahurei ki Māori, that is, unique to Māori, and therefore relate specifically to the research question: *What are the key contextual elements that shape Māori engagement in health behaviour change?* This question has already been addressed in *Section 6.1.1: Theme One: Māori Social Context.*

6.2.1.1 OUTCOME BELIEFS

The *outcome beliefs* subtheme revolves around the beliefs an individual has toward using a health application, and whether they think that the application itself would be beneficial to them. At the start of each hui, it was important to determine if participants believe that it is acceptable to deliver a health behaviour change intervention on a smartphone device. Participants across all hui agreed that devices could be useful support tools, and several participants reported using their devices in this way. The following statement was made in response to a question about whether participants thought that mobile phones could be used to support people to make healthy lifestyle changes:

> *"I think a phone would work in that sense; I have used phones before to keep me motivated. But that's another thing, is a person staying motivated. But I am saying that a phone would be helpful way of reminding us." (19/109#2)*

This extract is representative of all hui, most participants responded positively to this question, and no one disagreed. There were a couple of participants who did not offer a verbal response, and this was common practice as not every participant answered every question. Once there was a consensus that smartphones might be useful in this context, I set about to explore the perceived role of technology in supporting positive health behaviour change.

This study found that most participants believe that fitness applications may be beneficial to people wanting to adopt healthy behaviours. This is demonstrated by the participants' previous use of smartphone applications such as *MapMyRun*, *MyFitnessPal*

and wearable devices such as *Fitbit*. All participants had personally used smartphone applications, fitness trackers, or other wearable devices to track physical activity or to help them meet personal weight loss goals at some time in their lives.

Participants recognise the need for becoming more active and making healthy eating decisions, and participants can clearly describe what healthy activity and eating looks like to them personally. Overall, participants agreed that becoming more active would have positive outcomes for their health. The following extract is in response to the question *what does healthy eating look like to you*?

> *"Just restrictions on the clearly end-zones of unhealthy-ness like fizzy sodas and that. And then restricting to just water and then instead of having quick and easy meals, having the meals that are... You know it's healthy because you know what's in there, you know, the things that you put in there." (19/285#2)*

This extract demonstrates that the participant is aware of which elements contribute to a poor diet and recognises the benefits of eating home-made food that has been cooked from scratch and where the cook knows the ingredients and steers away from convenience or pre-prepared foods.

Participants generally agree that the intention to adopt and continue with a health behaviour-change programme begins with the individual deciding to make a lifestyle change. Several participants across the dataset had started an exercise or weight loss programme at some stage in their lives and each had a unique trigger for beginning the journey. The participant in the following extract is responding to the question *have you ever started a healthy lifestyle journey? And what made you start if you don't mind me asking*? Although the phrase used was *healthy lifestyle*, participants assumed the question related to weight loss:

> *"Yeah, I had a health scare a few… couple years back, I was worried about it, so I started getting fitter like… going to the gym and that, trying to cut out those fast foods and drop some kilos." (19/310#2)*

In this case, she took the health incident seriously and became committed to achieving a healthier lifestyle and in addition to working out at the gym, she also hired a personal trainer to help keep her on track. Another participant also discussed her trigger, in this case she was invited to a wedding and felt she would like to look slimmer for the event as she was anxious about how other people would perceive she looked:

> *"I gotta go to a wedding next month, I want to lose some weight." (19/109#1)*

These extracts demonstrate that there is no single reason for choosing to make lifestyle changes, triggers typically included health events, or anxiety about personal appearance. Not all participants stated they had started a healthy lifestyle journey, but those that did were invariably women. The male participants did not contribute to that discussion but rather talked about using fitness applications and activity trackers as part of a healthy lifestyle.

When asked about smartphones as support tools and what that might specifically look like, participants talked about reminders, advice, tracking activity, and suggestions for ways to make healthy lifestyle adjustments. The following extract is an example:

> *"Sometimes people just don't know what they're doing wrong either eh. Or they don't know ways to fix it, or say, cooking for example. I'm just thinking I often just eat Weetbix [for dinner] as I don't know what else to cook. So, it would be good to have those suggestions where it's on hand. I [can] just go oh, that looks nice." (19/310#1)*

This extract is representative of the whole dataset; participants across all hui gave multiple examples of specifically how smartphones could be effective in a support role. Participants were aware that a smartphone's in-built technologies can provide useful functionality that would support healthy lifestyle changes such as setting reminders to undertake physical activity, autonomous tracking activity, creating food diary logs, and monitoring progress or improvement. Consequently, the implications for design are that participants perceive smartphones may be efficacious in supporting positive health behaviour change and further, that many of a smartphone's embedded sensor technologies such as location sensing and accelerometers could be leveraged within the design.

This subtheme has shown that participants believe that a health application would be beneficial to them, and they also made positive comments about using technology to support health behaviour outcomes. The subtheme also shows that individuals have unique reasons for beginning a healthy lifestyle. Their decision to use a health application or make a lifestyle change may be triggered by a health event, an important social event, or any number of other reasons, what is clear, is that the individual makes an autonomous decision to act. The design implications are that it is important to recognise that the journey to improved health is deeply personal, and therefore recognising that people are on different pathways, or that they have arrived at the decision in different ways suggests that individuals may have different approaches to using a technology, or different expectations about how it might help them.

6.2.1.2 CONTROL BELIEFS

The *control beliefs* subtheme reflects the participants' expressions that any factors which may facilitate or inhibit their adoption of a health behaviour change intervention are within their control. Additionally, it includes their individual perceptions of the relative ease or difficulty of using a health application. To explore whether participants believe they can complete a behaviour, it is important to first explore their fundamental beliefs about the efficacy of the behaviour. It is interesting to note that participants across the entire dataset expressed the idea they had the ability to make healthy lifestyle changes. While this study is specifically exploring the use of gamification in health behaviour change interventions, it is important to also explore whether participants could identify any personal barriers or doubts about their own ability to participate. In the following extract the participant is responding to discussion about their own experiences with fitness technologies:

> *"It would be like… that person is not that tough, if they can do it, I can do it" (19/310#4)*

Participant 19/310#4 is demonstrating that she felt capable of undertaking a health change, and to complete challenging activities, she is reflecting that if she can see other people can easily use the technology, she expects she could also do this also. In this context participants were discussing using applications to track running activities.

In general, participants agreed that they personally felt that health behaviour change was within their own abilities if they chose to undertake it, they also expressed the belief that technology could be used to support health behaviour change and that they had the skills to use the technologies. This is interesting as participants represented a broad range of age groups and had varying degrees of experience with smartphone applications. Some participants expressed concerns about adopting an mHealth application, and it is interesting to note that generally this negativity relates to an individual's personal experience, whereas in many cases the positive attributes were discussed both individually and collectively. The subtext is that the negative aspects of adopting technologies render as excuses; if people are committed and motivated to achieve wellness goals, then the obstacles appear non-existent.

One of the barriers that participants identified relates to connectivity. In the context of this study, participants were discussing the connectivity of smartphones, therefore, this discussion excludes devices such as desktop, laptop, or tablet devices. Participants identified two ways they connect to the internet: using mobile data or using Wi-Fi. To

ensure that there was a clear understanding around device accessibility for Māori, I asked; *do you think most Māori adults have access to a device*? This was followed up with the question *is it common for everybody to have a device or connectivity*? As illustrated in the following extract from the first data collection hui, devices are accessible to Māori that want them, so this is not a significant issue, the problems relate to connectivity and the cost of data:

> *"Access to a device isn't a problem. It's affordability, so there's that, data [cost]" (19/285#1)*

This study found contradictory experiences relating to connectivity. No participants stated that they personally used mobile data to connect to the internet, and all mentioned they had access to Wi-Fi at home and via public hotspots. When asked about the experiences of other Māori, participants recalled they knew people who had little access to Wi-Fi at home, particularly Māori youth. The participant in the following extract is aged 18-24, he usually resides in a remote location in a remote region and is discussing issues communicating with his friends:

> *"Kind of depends on where you are. I'm not too sure about Hamilton but where I live lots of kids go to the library because none of them have houses with Wi-Fi. That's a big problem. […] They are limited by the Internet access, and we aren't able to communicate with them" (19/285#2)*

This observation of some connectivity issues is confirmed by another participant in the same hui, who is wondering whether the difficulty with connectivity is more prominent in remote, or rural locations:

> *"In Whakatāne, the library's quite a common place for... you see a lot of people go and use the Wi-Fi at the library and whether they don't have wi-fi at home or not. Maybe around Rūātoki or Taneatua or one of those areas might be [a problem]. In those more rural areas" (19/285#3)*

It is interesting to note that even in situations where Wi-Fi access at home is limited, there is access to community Wi-Fi such as in libraries and on marae. Participants expect to be able to connect to Wi-Fi for free from almost any location and they report being adept at finding central points of connection such as schools, libraries, and telecommunications providers hotspots. Participant 19/285#1 mentions that there is a strong sense that connectivity is ubiquitous and that access to free data is important.

"I don't use my own data at all. I think I used maybe five bucks one time. And that was because I was on the road driving down the country and I just kind of stopped in different places. But everywhere I go there's free Wi-Fi." (19/285#1)

All participants in hui 19/285 agreed that although connectivity is raised as a barrier, people who are motivated to, will find ways to access a data connection.

This subtheme has presented the participants' expressions that they believe that they would personally have no difficulty using a health application, and furthermore, that the factors which may facilitate or inhibit their adoption of a health behaviour change intervention such as access to Wi-Fi or mobile data are within their control. The implication for design may be that the issue of mobile connectivity is not necessarily an inhibitor of adoption as finding a connection is within an individual's control.

6.2.1.3 SELF-MOTIVATION

In this subtheme, *self-motivation* specifically relates to an individual's decision to adopt a healthier lifestyle and their individual impetus to repeat the behaviours consistently. One key conceptual idea is that regardless of whether participants have personally undertaken a healthy lifestyle journey, they all agreed that a health application by itself would not motivate anyone to choose to begin a health behaviour change programme, rather, the key to beginning a programme was *self-motivation*. The following extract comes from a conversation about whether participants perceived that a mobile health application could support people to make healthier lifestyle choices:

"I think the phone, or any technology really is just a support tool if you haven't made the call the tool's not going to be any use to you." (19/109#4)

In this case, the participant acknowledged that technology could have a supporting role, but unless a person has made a commitment to make lifestyle changes, an application would have little impact on motivation. This is an important distinction because it evidences the idea that motivation cannot be applied externally. To explore this further, the following participant was asked what had triggered his initial motivation for using the health and fitness application *MapMyRun* to track his mountain biking activity:

"That would be when I'm ready I suppose, my motivation. So, the app doesn't drive me, I drive the app." (19/285#1)

This extract implies that when the participant is ready, they will choose to undertake the behaviour but the feeling of being in control or retaining autonomy over the decision was important. This extract also signals the attitude of participant 19/285#1 and shows that

there is a disconnect between the knowledge that a healthy lifestyle is beneficial, and individuals choosing to undertake behaviour changes. The following extract demonstrates that participant 19/285#1 understands that being active is in his best interests but has a negative attitude toward the behaviour itself. He made several statements suggesting that he knows what was good for him, and chooses not to engage with the behaviour:

> *"That's called a gym membership, everyone signs up. I know it's good for me, but do I go? Not as much as I should." (19/285#1)*

Participant 19/285#1 is an individual with an active lifestyle, he undertakes activities such as mountain biking, and recognises that due to recent time constraints he has been unable to do this as frequently as he had previously. His comment about gym membership suggests that he believes his phone could support him to undertake a positive health behaviour-change but also shows that he is resistant to doing so. In general, participants were aware of the behaviours required to improve health outcomes but may be unwilling or unmotivated to undertake the behaviour.

A sense of autonomy is an important aspect of self-motivation, as is the belief that an application will help support behaviour change. This conceptual idea was common across the whole dataset, and the participant in the following extract expresses a similar view to the previous participant by explaining that she believes that an application could help her achieve her goals.

> *"It would be encouraging to see what you have done [goals completed] and what to do [future behaviour]. If I'm going to do it, I'm going to be motivated myself instead of an application… whatever, telling me when to do it." (19/109#3)*

Like most other participants, 19/109#3 recognises that a behaviour-change intervention may offer support; however, the need for the individual to be in a state of motivation is crucial. Motivation is internalised and therefore the impact of gamification will likely have no effect on an individual's continued use intentions until they operate in a state of motivation.

This concept was illustrated by several participants, who said that using an application which provided feedback on their performance would help keep them on track. In the following extract the participant is describing how apps with feedback on current performance compared to previous performance help keep her motivated. She is specifically discussing that she holds herself to account for ensuring she keeps working out at a higher intensity level than she might if she didn't have access to that feedback:

"You know when you're working out how hard you're working out, your intensity levels, or if you could do more." (19/310#1)

Internal accountability is an individual's ability to justify their actions or behaviours to themself. Internal accountability has strong links to motivation and using current or past activity as a benchmark for setting personal challenges is important. This has important implications for design because it demonstrates that real-time feedback contributes to internal accountability and suggests a link between goal setting and motivation.

Theme Two: Underlying beliefs has explored three key aspects of behaviour change theory: outcome beliefs, control beliefs, and motivation. It has discussed participants' perceptions toward health behaviour change technologies and to what degree they consider that such a technology would be beneficial. It has also explored the concept of self-efficacy, and the participants perceptions of their ability to overcome barriers for adopting a technology for improving health outcomes. Furthermore, this theme also discussed self-motivation and accountability as motivators in health behaviour change technologies.

The research question relating to this theme is *Which persuasive strategies are effective in gamified physical activity and diet interventions for Māori?* To address this question, it was important to first explore the fundamental beliefs that participants have towards these technologies. *Theme Three: Persuasive strategies* investigates the participants understanding and preference for ten potential persuasive strategies previously identified in the literature.

6.2.2 THEME THREE: PERSUASIVE STRATEGIES

Persuasive strategies are constructs designed into an information communication technology to encourage adoption and continued use. Ten strategies were previously identified in the literature, and these were presented previously in *Section 2.6: Persuasive Strategies in Technology*. These strategies are frequently found in information technologies such as mobile applications and computer software. Persuasive strategies may be considered as reasons that motivate continued use intentions and engagement for any software. As part of the hui process participants were each given two sets of cards: a set of cards containing ten persuasive strategies, and a set of cards containing ten game design elements. The design process of these cards is presented in *Appendix F – Design of Card Artefacts*. This section contains explanations and examples for each of the persuasive strategies.

The *persuasive strategies* cards were introduced during the co-design hui; the meaning of each card was explained and discussed with the participants to ensure everyone had a similar understanding of the individual strategies. Participants were invited to select five strategies

that might motivate them personally to become more physically active, and to make healthier food choices. The initial intention was to ask participants to rank all ten cards. However, the pilot hui indicated that this was time-consuming and most participants struggled to complete the task. Therefore, participants were asked to rank their top five persuasive strategies where 1 is the most preferred, and 5 is the least preferred strategy.

The rankings by individual participants are shown on Table 6.4. It is interesting to note that multiple participants selected more than five strategies, and therefore this table does not present any statistical analyses relating to these findings other than frequency. This table illustrates that according to individual participants, Āhuatanga urutau (customisation) was the most frequently ranked persuasive strategy. However, it was ranked 3 or lower by 6 out of 10 participants. In contrast, Whakataetae (competition) was the second most recently ranked persuasive strategy and 7 out of 9 participants ranked it highest or second highest on the preferred strategy list.

Table 6.4

Individual preference of persuasive strategies for self-motivation

Participant	Whakataetae Competition	Mahi Tahi Cooperation	Whakatauritenga Comparison	Āhuatanga urutau Customisation	Tautuhinga Personalisation	Momoho Reward	Mihi Praise	Whakahoki kōrero Feedback	Marohi Suggestion	Whakataruna Simulation
19/285 #1	3			2	1			4	5	
19/285 #2	1	2		4	4		3		6	
19/285 #3	2	3	1	5	4					
19/109 #1		2	4			5	1			3
19/109 #2		1		6	6	3	2	4		
19/109 #3		1			3		2		5	4
19/109 #4				3	1			4	2	
19/109 #5	2	4	1	3		5				
19/310 #1	2	1		5			4		3	
19/310 #2	5			2	1			3		4
19/310 #3	1			2		4		3		5
19/310 #4	2			1		5			4	3
Frequency	**9**	**7**	**3**	**10**	**7**	**5**	**5**	**5**	**6**	**5**

The purpose of the task was for the participants to become familiar with the strategies and to think about which they thought would be self-motivating. Reducing the number to five still offered valuable data and it allowed the participants to begin discussing why they had chosen what they did. In two cases, there are more than five selected strategies (see 19/285#2 and 19/109#4), this was because these participants determined there was no significant differences between Āhuatanga urutau (customisation) and Tautuhinga (personalisation).

The literature had suggested that socially-oriented strategies such as Whakataetae (competition), Mahi Tahi (cooperation), and Whakatauritenga (comparison) might be the most effective motivating persuasive strategies. However, this table indicates this may not be the case since Whakatauritenga (comparison) was the least-commonly selected strategy. Āhuatanga urutau (customisation) was the most frequently selected persuasive strategy, followed by Whakataetae, Mahi Tahi, and Tautuhinga (personalisation).

The frequency of each strategy is interesting because in most cases it contradicts what participants said about these strategies in later discussion. These differences will be discussed in the following section where relevant findings for each conceptual idea are expanded. Following the ranking of strategy preference for each of the participants individually, they were asked to determine which strategies they thought would be most effective, or most motivating if they were designing an application to support behaviour change specifically for Māori. A form of collaborative decision-making to obtain consensus between all participants in each separate hui was used, rather than apply a formal system for determining consensus (Larson, 2013): Each group could determine their own method of finding agreement. In all instances, participants discussed what they personally chose and why, and then identified which strategies were common across the hui. Then the participants discussed the merits of the remaining choices until they had a unanimous list of five strategies. A summary of the choices is indicated on Table 6.5, this table shows which strategies were selected for further discussion in each hui, and within each hui only these strategies were discussed further.

Table 6.5

Incidence of persuasive strategies preference for motivating others

	Socially-Oriented Persuasive Strategies									
Hui	**Whakataetae Competition**	**Mahi Tahi Cooperation**	**Whakatauritenga Comparison**	**Āhuatanga urutau Customisation**	**Tautuhinga Personalisation**	**Momoho Reward**	**Mihi Praise**	**Whakahoki kōrero Feedback**	**Marohi Suggestion**	**Whakataruna Simulation**
19/285	Yes	Yes		Yes	Yes				Yes	
19/109		Yes	Yes			Yes	Yes	Yes	Yes	
19/310	Yes	Yes			Yes				Yes	Yes
Frequency	**2**	**3**	**1**	**1**	**2**	**1**	**1**	**1**	**3**	**1**

The chosen strategies were not ranked by participants, they simply reflect choices. Although, it is interesting to observe that Mahi Tahi (cooperation) and marohi (suggestion) were chosen by all groups. Hui 19/109 chose six strategies because they were unable to agree whether momoho (reward) or mihi (praise) should be on their list, so both are included. This is not considered to be problematic as the value of the data comes from what the participants said about each strategy rather than the number of times it was discussed.

Although ten potential persuasive strategies were presented to the participants for discussion, participants found similarities between some of the concepts. An example of this is āhuatanga urutau (customisation) and tautuhinga (personalisation): Participants agreed that they did not perceive a difference between human-side or computer-side adaptations, the important aspect for participants was that the application met the needs of the individual user. This differs from the literature presented in *Chapter Two* as in all instances, when the participants from multiple hui determined that two or more strategies were indistinguishable, these strategies were combined leaving a total of six persuasive strategies as determined by participants. A summary of the merging of the strategies is presented Table 6.6. It is important to note here, that in some cases the discussion about the similarity between strategies occurred during the selection process, and hui participants may have selected different strategies for further discussion.

Table 6.6

Convergence of persuasive strategies

Original Persuasive Strategy	Final Persuasive Strategy
Whakataetae (Competition)	Whakataetae (Competition)
Mahi Tahi (Cooperation)	Mahi Tahi (Cooperation)
Whakatauritenga (Comparison)	Whakatauritenga (Comparison)
Āhuatanga urutau (Customisation) Tautuhinga (Personalisation)	Āhuatanga urutau (Customisation)
Momoho (Reward) Mihi (Praise)	Momoho (Reward)
Whakahoki kōrero (Feedback) Marohi (Suggestion) Whakataruna (Simulation)	Urupare (Feedback)

In the context of designing health behaviour change interventions for Māori, participants determined that six persuasive strategies were important: Whakataetae (competition), Mahi Tahi (cooperation), whakatauritenga (comparison), āhuatanga urutau (customisation), momoho (reward), and urupare (feedback). These six persuasive strategies are redefined and discussed in the following subsections. The decisions to merge the remaining four strategies are discussed for each of the concepts in the following subsections.

Māori lived experiences are expressed in the voice of the participant and therefore the extracts presented in this section will contain the original language as used by the participant. A translation is included where the meaning of Te Reo is not clear. For the sake of clarity, when participants are using the word *whānau*, they were talking about 1-2 generations of people typically residing in the same house. It is acknowledged that although the word *whānau* also means an extended family group including relatives living in other locations, this is not the context of the usage for participants in this study.

6.2.2.1 WHAKATAETAE – COMPETITION

The persuasive strategy *Whakataetae (competition)* is a driving force in Māori culture that produces a strong emotional response. Whakataetae challenges people to contest their wits or strength against each other and rewards the highest achievers for reaching their goals individually. The concept of whānau support was previously discussed in *Section*

6.1.1: Theme One: Māori Social Context, and this concept can be further expanded to explore the concepts of *intra-whānau rivalry* and *inter-whānau competition*.

This study finds a perceived difference between *rivalry* and *competition*. In the following extract, the participant is responding to another participant who suggested that rivalry inside the whānau could have motivational benefits. However, in the second half of this extract he is referring to whānau competition in the context of an extended family group such as hapū or iwi, and has changed from talking about a health technology, to talking about a physical sporting competition.

> *"I just realised that it could [motivate people] if you introduce this to the whole family... Because, if it's an application that everyone can get on their phone and you put up a little group with the family in it, and then you have your goals and the brothers and sisters have a little rivalry and they try to compete against each other. It's a big thing within our whole [community], our schools, all around. It's mainly this competitiveness between families that usually motivate us to do better, especially like kapahaka (competitive dance) and stuff. Try to out haka each other, […] it's usually competitive. It's like fun but like the main goal is to beat the person and that really motivates everyone, even the little kids, to try their best." (19/285#2)*

This extract introduces the conceptual idea that rivalry occurs within whānau, and competition occurs between whānau. This study has found there are two forms of competition in Māori culture: intra-whānau, and inter-whānau. *Intra-whānau rivalry* is a form of friendly competition such as that which occurs between siblings and is a light-hearted competitive experience. This is separate from *inter-whānau competition*, which is a form of serious competition where the winner takes all. The distinction between intra-whānau and inter-whānau competition is important because participants expressed there is a difference in their emotional responses to each.

6.2.2.1.1 INTRA-WHĀNAU RIVALRY

Intra-whānau competition exists as low-key rivalry between whānau members such as siblings, and participants generally agree that a little rivalry inside the home may be beneficial to helping people achieve their health goals. However, they also agreed that rivalry does not necessarily lead to a heightened sense of emotion. Participants said that while intra-whānau rivalry would be encouraging, it would not be enough to encourage their continued use of an application. The following extract demonstrates the sense that competition within the whānau would not be motivating:

"If it's just like a notification that your brother got a higher [achievement], it wouldn't really motivate me that much." (19/285#3)

Furthermore, participants stated they would find competition within the family unit to be demotivating. In the following extract, the participant is responding to the question: *Do you think Whakataetae within your whānau group would be motivating, or demotivating?* The question is exploring the relationship between social connection and competition:

"We're a competitive family but we would rather compete against other people, it might break out into a fight […] and I think we won't achieve it if we do it by ourselves" (19/310#1)

This extract illustrates the idea that competition may have a negative, or demotivating effect on the individual's continued usage of a smartphone application if competition is used to motivate within the family group. Rivalry and competition are perceived differently, and discussion about competition and competitiveness elicited a heightened emotional response from participants.

The following extract demonstrates a preference for collaboration and support within the whānau, and a natural sense of fierce competition for everyone else:

"We want to work together with our own people but everyone else is fair game." (19/310#2)

Furthermore, participants stated that they did not want to be competitive against members of their own family and described competition as being fundamentally detrimental to familial relationships.

More specifically, participants would prefer to be cooperative within the whānau group. Participants stated that if they didn't know the other people in the application then they felt compelled to win and would experience an intense emotional excitement toward winning.

6.2.2.1.2 INTER-WHĀNAU COMPETITION

This study finds that some Māori have a strong sense of social competitiveness against people outside their immediate whānau, and between different whānau groups. *Inter-whānau competition* is a strong emotional response that contributes to the experience of intense excitement felt by different groups when facing sporting or competitive challenges. Some participants expressed the idea that some Māori are a particularly competitive people and the following extract as an expression of this idea:

"I think a lot of us are real competitive, I think that's what gets the blood going" (19/310#1)

There are multiple examples of serious inter-whānau, or inter-iwi competition expressed across the whole dataset. Examples of such serious competition demonstrated in the following extracts:

"In Whakatāne they have a thing called Ngā Whātua [the Ancestors] Challenge, which is where Ngāti Awa are up against Tūhoe, two iwi [tribes]. There's a competition with a lot of sports, so you have touch, and you have kioraki, and netball. You get all these different sports where you compete and it's like a constant bringing, a constant rivalry between two iwi." (19/285#3)

"There was an app [computer game] I remember called Pa Wars. Mostly we have Pa Wars now anyway… which is Tūhoe [a specific Māori tribe] business" (19/285#1)

The expressions *constant bringing* and *Tūhoe business* indicate the seriousness that underpins these competitions, with the winners earning prestige and kudos, as discussed again by participant 19/285#1 in the following extract:

"It's all about bragging rights. You know, it's not so much that we have to beat you, it's more about we want everyone else to see that we beat you". (19/285#1)

This section has shown that whānau are a strong motivating force in behaviour change interventions, and that whānau decisions to increase activity can have a positive impact on programme adherence. It has also shown that competition within the whānau is not particularly motivating, but competition within the wider community such as iwi against iwi is highly motivating and creates a heightened emotional response, an example of this perception is illustrated below:

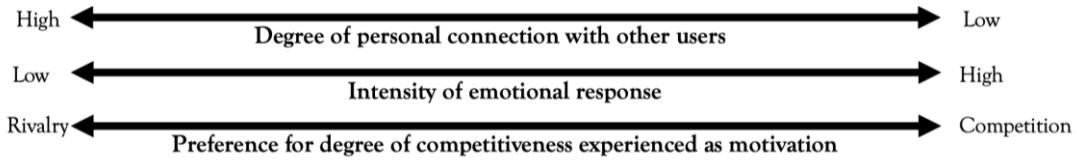
"I personally think you're on to something there because like personally I could say that yes I would if we had […] a fitness app. I would be happy to compete with my family against other Māori families. I wouldn't want to compete against my own family." (19 Our community is important eh? We have this thing, it's… we have 'hei painga mo te katoa', which means we do it for the benefit of everyone. It's not just about me, me, me, at least not where I come from. Does that make sense?/109#5)

This extract suggests that the higher the degree of personal relationship an individual has to other people using an application, the lower the emotional response or sense of competitiveness the individual may experience, and therefore the lower likelihood that

competitive persuasive strategies will effect a user's motivation. Conversely, the lower the degree of personal relationship an individual has to other people using the application, the higher the degree of competitiveness they may feel and therefore, the higher the likelihood that competitive strategies will be effective on a user's motivation. A summary of these findings is illustrated in Figure 6.1.

Figure 6.1

Intra-whānau rivalry and inter-whānau competition



Presentation of the findings relating to Whakataetae have demonstrated that participants do not necessarily find competition motivating, and in fact, there are some situations where competition is demotivating. The next section will present findings relating to cooperative strategies, particularly in relation to intra-whānau relationships.

6.2.2.2 MAHI TAHI – COOPERATION

The persuasive strategy *Mahi Tahi (cooperation)* suggests that some Māori are motivated to work collectively to achieve a common goal and share a reward when this goal is reached. This study found that some Māori prefer collective goals, particularly when the goal benefits all members of a whānau, as may be the case with a health behaviour-change programme. The following extract demonstrates the idea of family members working to support each other to adopt a health behaviour-change programme. Participant 19/281#1 is contrasting Mahi Tahi with Whakataetae, stating that if the goal is to improve health outcomes for the whole whānau then cooperation is important. This is noteworthy as it relates to the purpose of the smartphone application. If the purpose is to improve health outcomes, Māori prefer to work together. However, if the purpose is for fun or social interaction, then the preference is for Whakataetae (competition).

> *"You want to help your fellow whānau members and you want to be helped by your whānau. So, cooperation should be high but, you want to kind of pit each other against each other I suppose… if you come from the approach of well-being versus the approach of fun" (19/285#1)*

The idea of Mahi Tahi was common across all hui, it is a persuasive strategy selected by all participant groups, and is demonstrated again in this extract from a different hui:

"Our whole whānau works together instead of individuals inside the family working against each other. […] I think if you're working as a group you want to better the whole group instead of [just] yourself" (19/109#3)

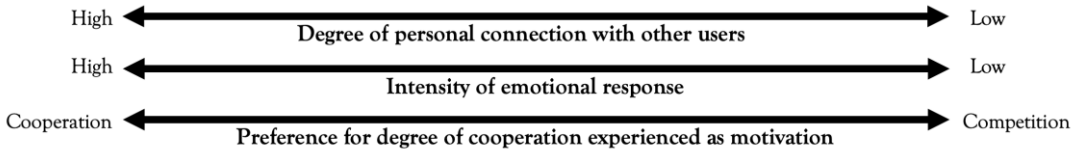
Again, participant 19/109#3 is making it clear that Mahi Tahi is an important component of Māori social orientation. By comparing Mahi Tahi to the comments made previously in *Section 6.2.2.1: Whakataetae (competition)* about a preference for Whakataetae, when other application users are unknown to the individual, it is apparent that there is a different emotional reaction toward other users, depending on the degree of personal relationship as demonstrated once again in this extract:

"Yeah, if I don't I know you, you're fair game." (19/310#1)

Experiences of Mahi Tahi discussed in this section suggest that the closer the personal relationship an individual has to other people using the application, the higher preference for cooperative strategy preference. These findings also suggest that participants will experience higher levels of motivation and commitment to achieving goals collectively. A summary of these findings is illustrated in Figure 6.2.

Figure 6.2

Experiences of preference for collaboration or competition



Presentation of the findings relating to Mahi Tahi have demonstrated that participants find intra-whānau cooperation motivating. The next section presents findings relating to strategies of social comparison, particularly in relation to both Whakataetae (competition) and Mahi Tahi (cooperation).

6.2.2.3 WHAKATAURITENGA – COMPARISON

Whakatauritenga (comparison) is a persuasive strategy that suggests that when an individual can see and compare their current performance against the performance of others. This visibility will challenge them to improve their performance or strive to achieve their personal goals. Whakatauritenga does not relate to users tracking their own improvements over time, tracking is the concept of urupare (feedback) which is described later in *Section 6.2.2.4: Āhuatanga urutau (customisation).*

Whakatauritenga is associated with both Whakataetae (competition) and Mahi Tahi (cooperation): Whakatauritenga relates to Whakataetae as visibility supports self-competition; and it relates to Mahi Tahi in that it supports connected individuals to help each other achieve a common goal. Whakatauritenga has a strong association with self-competition because being able to compare an individual's own performance against the performance of others challenges the user to improve their performance. Whakatauritenga requires a form of comparative visualisation such as statistics or leaderboards. Participants stated that comparative visualisations could be motivating in one of two ways: in the sense of comparing yourself to someone else, and then using that information to inspire you to work harder, as in this example:

> *"So, it's just good seeing that visually because you could be tired, but you could give way more than what you're giving" (19/310#1)*

Whakatauritenga also has a strong association with Mahi Tahi, this point is illustrated in the following extract where the participant is explaining how individuals can work together to inspire each other to improve:

> *"… say I'm matched with another woman, the same age, the same kind of weight, the same kind of goals, and say you're […] trying to beat each other. That would be really cool, but it would also be a really cool way if you had the opportunity to chat with that person and be like… how are you going? You could form a little team where you empower each other… but then you kinda wanna beat each other too." (19/310#4)*

This extract is interesting because it also illustrates that whakatauritenga is associated with Whakataetae. Participant 19/310#4 discusses that in-app communication can benefit users particularly when it creates a sense of community, or connection, but that this sense of community does not prevent a sense of competition occurring between users who want to help, but also to beat, each other. It is interesting to note that the participant is suggesting that an application could create groups of users based in descriptive characteristics, and not necessarily based on close personal connections. This suggests that a lack of personal connection might underscore the sense of competitiveness.

So far, this section has explored three strategies that are important in designing health behaviour change interventions for Māori: Whakataetae, Mahi Tahi, and whakatauritenga. Each of these strategies has a social orientation in that each requires the inclusion of other players or application users to be effective. The following three persuasive strategies may

be considered to have an individualistic orientation in that they are of specific importance to the focal user.

6.2.2.4 ĀHUATANGA URUTAU – CUSTOMISATION

Āhuatanga urutau (customisation) is a result of the combination of two separate persuasive strategies that were originally identified in the literature: Tautuhinga (personalisation), and āhuatanga urutau (customisation). Tautuhinga occurs when the software application automatically adapts the contents and services depending on certain pre-determined characteristics of the user such as age, weight, and activity levels; whereas āhuatanga urutau (customisation) allows an individual to control functionality and adjust contents within the application based on their own personal preferences, such as individual goals, or modified graphical appearance. When participants were discussing personalisation, they also talked about customisation, and used these terms inter-changeably. A probable explanation is that participants perceived these concepts to be similar, an example of this notion is illustrated in the following two extracts:

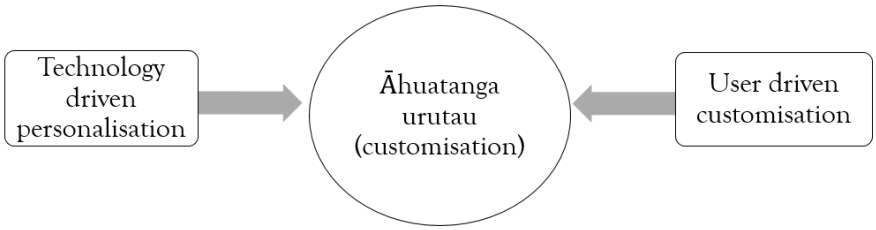
> *"So, with that… personalisation... if we're talking that, personalisation [and] customisation go hand-in-hand. I think you do need to be able to have a really pretty app and you need to be able to adjust it." (19/310#4)*

> *"I couldn't decide [between] tautuhinga, personalisation and āhuatanga urutau, customisation." (19/109#2)*

Therefore, based on participant discussion, *personalisation* and *customisation* are combined into a single persuasive strategy on the basis that the origin of the adaptation is less important than the occurrence of customisation. Figure 6.3 shows that technology driven, and user driven adaptations converge into the final āhuatanga urutau theme.

Figure 6.3

Construction of āhuatanga urutau



Participants consider that āhuatanga urutau is important from two perspectives: Māori-centric design, and individualisation. This study is designed around tikanga Māori (cultural protocols) principles and takes a co-design approach, and therefore, any subsequent artefact will focus on supporting Māori to make heath behaviour changes. However, participants felt that a Māori-centric approach is not enough and that an application must also adapt to the needs of individual users. The following extract is in response to the question: *can tell me why you have chosen personalisation?*

> *"Because even though we're Māori, our bodies are built different, our minds are built different. So, I think it needs to be personalised in order for it to work for the individual person." (19/310#1)*

This extract demonstrates the importance meeting the needs of individuals, and of individuals having autonomy and control over the settings of an application. This also reflects an individual's desire to customise that look of the application using avatars and skins (which will be presented in *Section 6.3.1.9: Whakatangata – Avatars*).

6.2.2.5 MOMOHO – REWARD

Momoho (reward) is a result of the combination of two separate persuasive strategies that were originally identified in the literature: momoho (reward), and mihi (praise). Participants commonly stated they did not perceive a significant difference between momoho and mihi, regarding both as rewarding the user in some way for completing an action or behaviour.

Momoho are given to application users for performing a desired behaviour or for completing a prescribed task, whereas *mihi* are a form of encouragement designed to support continued use of the application, and to congratulate users for achieving their goals. Momoho are often awarded as points and badges; and mihi typically take the form of text, images, symbols, or sounds. The similarity is perhaps stronger in software

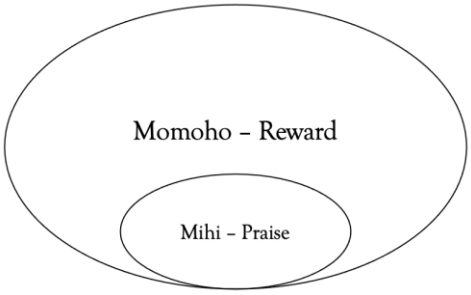
applications as rewards and praise are always given in a digital format. The following extract is indicative of the types of comments made by participants:

> *"Well then if you're gonna do [momoho] […] you'd probably do mihi as well, so, praise? They're a little bit similar and a little bit different, so like praise and reward." (19/310#4)*

Participants felt that mihi is a type of momoho; praise and rewards are given for achieving goals. The idea is that users receive a digital token, be it badges, points, text, images, symbols, or sounds as a reward, which in turn, will encourage them to continue to use the application, and encourage them to complete their goals. Figure 6.4 shows mihi is a subset of the momoho strategy.

Figure 6.4

Momoho (reward) construct



Participants view momoho as an important aspect of motivation, stating that rewards are a form of positive reinforcement. This idea is illustrated in the following extract:

> *"With these [rewards] you will be reinforcing the motivation […] because rewards are more of a soft thing for you to keep going, a motivation, where it's really a celebration when you get there" (19/109#4)*

In the following extract, the participant is discussing the relationship between rewards and motivation, stating that rewards inspire and motivate people, in this case, specifically as a reward for in-app competition. Participants 19/109#4 and 19/285#1 both perceive that rewards are given as a celebration of achieving a significant goal, and the reward itself should motivate the user to keep working to complete the goal.

> *"One of the things I was just thinking of is there has to be a really strong reward, so, for fun there's an instant reward." (19/285#1)*

Goals, in this context might be system-programmed desired behaviours, or user-selected target outcomes. Rewards are a type of digital feedback, and this study has found that

feedback is a discrete persuasive strategy dealing specifically with feeding information back to the user. This will be discussed in the persuasive strategy: urupare.

6.2.2.6 URUPARE – FEEDBACK

The persuasive strategy concept of *urupare (feedback),* is an important aspect of health behaviour-change as it supports both accountability and incremental improvement. Feedback in the form of system-generated commentary on performance can lead to programme adherence and increased motivation, both outcomes of accountability which were previously discussed in *Section 6.1.1: Theme One: Māori Social Context,* and *Section 6.2.1.3*: *Self-Motivation*. Participants suggested that users need to understand how they are tracking, and receive suggestions for improvement, taking action, or reaching their goals.

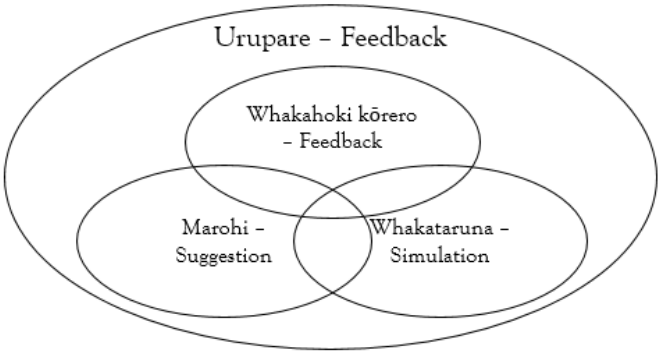
Urupare is a result of the combination of three separate persuasive strategies that were originally identified in the literature: Whakahoki kōrero (feedback), marohi (suggestion), and whakataruna (simulation). Participants stated that there were similarities between each of these concepts, and they combined them in their discussions: Whakahoki kōrero (feedback) manifests in smartphone applications as the ability for people to track their own actions and receive information about their current and past progress and improvements over time. Similarly, marohi keeps users engaged with the software by suggesting tasks or behaviours which may improve outcomes for the individual users. Whakataruna, feeds information back to users about what the effect of their current behaviour might be over time. In the following extract, participant 19/109#4 is discussing the merits of suggestion and feedback as persuasive strategies:

> *"Those are quite similar, so you want to use a suggestion and feedback thing going on within the group. So, this one here that suggests tasks which may improve outcomes, and feedback as well which allows you to take actions, […] we could just have one of them that talks about what you can actually do to improve your outcomes." (19/109#4)*

Participants felt that these three strategies should be linked to a single strategy relating to feedback communications since all three are system-generated commentary on their own progress or performance. The links between these three forms of feedback are illustrated in Figure 6.5. Urupare (feedback) is the label assigned to the combined strategy.

Figure 6.5

Urupare (feedback) persuasive strategy



Participants understood that a significant aspect of improving health outcomes is a clear evaluation of their current performance, and therefore, comparative data on historic performance and current performance is a critical design feature:

> *"… you want to compare how you're going in terms of health, from now to when you started, you're going to need some sort of measuring system" (19/109#4)*

This study found that urupare consists of feedback in the form of an evaluation of the user's current health or performance data in comparison to previous performance data is an essential characteristic of a health behaviour change intervention.

In addition to evaluation feedback, urupare consists of feedback in the form of mentoring or coaching. In the following extract the participant is explaining that sometimes when they arrive at the gym after work, they do not have the mental capacity to plan their own workout, and therefore having an application that can suggest an exercise programme for them is beneficial:

> *"I think sometimes when you think of doing something, you can't do anything in the small box, and then you don't think of everything else. I think that's where an app would come in. I think just like the workout generators they do your workouts for. You just push a button and then they should [suggest a] workout for you, and that's what you got to follow" (19/310#1)*

Further to this point, participant 19/285#1 is responding to a question about how they perceived technology could be used to coach people to make healthier lifestyle changes. His answer suggests that feedback and recommendations can simplify decision making and make programme adherence simpler:

> *"Anything that makes life easier for people is probably a good way of putting it. […] Any way in which you're able to get people [to eat better] whether the choice is*

recommended for you. In regards to data analytics that can, you know, provide suggestions for you to make a certain choice, and if you could, you know, have an app for that, there probably is some value in that." (19/285#3)

This section has shown that urupare consists of two key components: evaluation, and coaching. Both are important design elements of health behaviour change interventions as they give users a clear understanding of their current situation, and guidelines for improvement. The next subsection gives a summary of the persuasive strategies that are relevant to the context of designing health behaviour change interventions that are specifically aimed at improving health outcomes for Māori.

Theme Three: Persuasive Strategies has explored ten persuasive strategies that were identified from the literature and presented to participants at the hui to identify which strategies may be effective in designing motivation and continued use of a health behaviour change application. Of the ten original persuasive strategies, this study found that there are six persuasive strategies that are contextually relevant to the design of health behaviour-change interventions specifically targeted at supporting Māori: Whakataetae (competition); Mahi Tahi (cooperation); whakatauritenga (comparison); āhuatanga urutau (customisation); momoho (rewards); and urupare (feedback). The decision to combine some strategies was driven by the participants discussions, in multiple instances they simply talked about the strategies together or agreed within a hui that they perceived them to be the same.

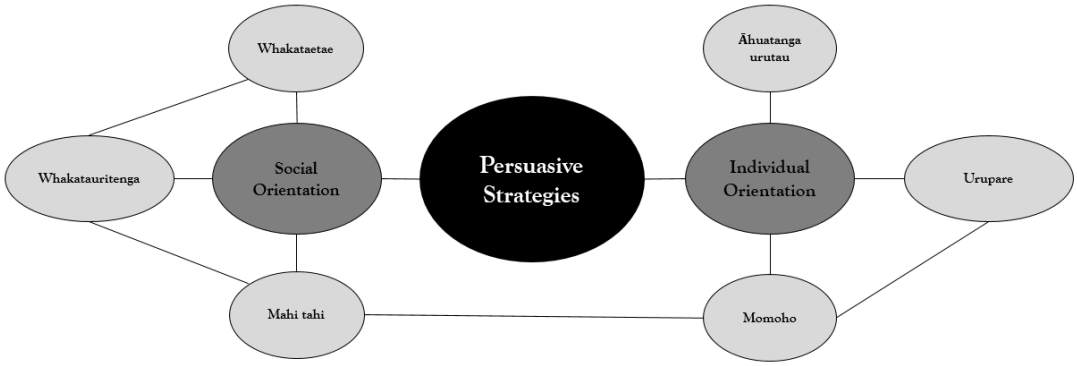
The presentation of this theme has shown two distinct orientations of persuasive strategies: Social orientation and individual orientation. Socially-oriented strategies are those that rely on interactions with other individuals or groups. This study has shown that Whakataetae (competition), whakatauritenga (comparison), and Mahi Tahi (cooperation) are all socially-oriented persuasive strategies. Conversely, individually oriented persuasive strategies are those that focus on the individual user, and include āhuatanga urutau (customisation), momoho (rewards), and urupare (feedback).

In addition to social and individual orientations, this study has shown that the persuasive strategies are strongly interconnected. Figure 6.6 shows that Whakataetae and Mahi Tahi are forms of social orientation, but also, they are both connected separately to whakatauritenga. Āhuatanga urutau is a type of individual orientation, as are momoho and urupare, however there are some similarities between momoho and urupare in that both are the product of in-app interactions. Figure 6.6 also shows that there is an association

between Mahi Tahi and momoho. This is because momoho can be awarded for collaborative behaviours, as well as desired behaviours performed by the focal individual.

Figure 6.6

Connections between socially and individually oriented persuasive strategies



Persuasive strategies are a critical aspect of designing motivational affordances and encouraging continued application use. This theme has demonstrated which strategies are expected to be the most effective in a health behaviour change intervention. However, this section has not addressed how these strategies should be used. *Theme Four: Game design elements* will explore game mechanics as participants discuss how each could be used to support these six persuasive strategies. Following that, *Theme Five: Matching Strategies with Mechanics* will present findings relation to how game design elements such as strategies and mechanics can be combined to design a health behaviour change intervention.

6.3 RESEARCH QUESTION 3

An important aim of this research is to be able to explain specifically *how* gamification can be implemented in an application designed to support Māori health. Two themes are presented as a response to the research question*: Which configurations of game design elements support specific persuasive strategies for Māori?* Theme four presents findings relating to the participants interpretations of various game design elements that had previously been identified in the literature; and Theme Five presents participants' ideas about how to integrate persuasive strategies with game design elements. It also suggests four target behaviours that can be used to develop exemplar combinations.

6.3.1 THEME FOUR: GAME DESIGN ELEMENTS

The previous theme identified which persuasive strategies were most important to Māori. *Theme Four: Game Design Elements* explores various game design elements to understand which combinations may be efficacious in supporting the persuasive strategies.

As previously identified in the extant literature, ten game mechanics elements were presented to hui participants as a set of cue cards. During the hui, these cards were discussed to ensure participants understood each mechanic. The mechanics cards were used as prompts to elicit ideas from participants about how they thought combinations of these elements might be used to support each of the previously identified persuasive strategies. Participants were encouraged to discuss real-world examples of what they meant and where they had seen this mechanic being used before. While the process sounds complicated, participants grasped the idea very quickly and there was some very lively discussion.

All participant ideas were recorded and will be presented in this section. Participants had previously chosen as a group the persuasive strategies they believed would be motivating to Māori and these were presented in the previous theme. As stated previously, the value in this data comes from the discussions between participants, not necessarily the choices that they made. Mechanics have been described as the building blocks of gamification design (Hunicke et al., 2004; Matallaoui et al., 2016) and are the elements a designed in various combinations to design the dynamic processes within an application – the real-time behaviours (Hunicke et al., 2004). The results of the combinations work together to generate emotional responses which are designed to encourage engagement, continued use intentions which support behaviour change. This study explores the mechanics that can be used to support each of the six relevant persuasive strategies.

Each of the following concepts had been previously identified in the literature, and the purpose of this activity in the hui was to explore how participants perceived these elements and to explore which elements might be combined to achieve the strategies agreed upon in the previous section of the hui. This section explores each of the mechanics individually, but recognises that they are all highly inter-related, for example, accumulated points may count towards a person progressing through levels, and badges may be awarded for completing achievements. Therefore, findings will be presented for each of the game mechanics, and then later discussion shows how combinations of mechanics can be combined to support each of the persuasive strategies identified.

6.3.1.1 KOHIKOHINGA – COLLECTION

Kohikohinga was identified from the literature prior to conducting the hui. Collection is commonly deployed in computer video games and allows a person to find and acquire individual items to complete a set within the game. There will be no findings presented in relation to kohikohinga as none of the participants in any hui discussed or mentioned

kohikohinga. This suggests that from the perspective of gamification, there is no perceived role or value for collections and therefore, there is no argument to explore kohikohinga.

6.3.1.2 TOHU – BADGES

Tohu are awarded in game and are a visual representation of a special quality or achievement for each player. Participants identified that public visibility of tohu is important, this demonstrates a type of social status within the application. In the following extract the participant was discussing that tohu can be given for successfully completing a difficult challenge:

> *"Or a momoho [reward]. If one of your tohu [badges] was to wear the manaia until someone else took it off you, that would be part of that group, you'd be the guy in the group that wears the manaia. That's the reward." (19/109#4)*

In this instance the player's digital representation of self, or avatar, has been rewarded a manaia (common motif in Māori carving and jewellery) which is a taonga (treasure) that is worn usually around the neck. The participant recognises that an individual may perform a challenge on behalf of the group, but the whole group would benefit from the social recognition of having that individual as part of the group. The manaia can be used to decorate their avatar which can be seen publicly by other players.

Tohu (badges) may be a highly sought-after reward for achieving a significant challenge. This was a common notion across the entire dataset, in the following extract, the participant is illustrating the inter-relationships between multiple game design elements:

> *"If you were going with your challenges and every time you complete a quest you get a badge. I think they kind of go hand-in-hand." (19/310#4)*

In this instance, the concepts of rewards, badges, challenges, and achievements are all highly connected.

6.3.1.3 MĀKA – POINTS

Māka are a unit of scoring that are awarded to players for success or for performance. Typically, points can be accumulated and may be recognised as representative of status or experience. Māka were useful in persuasive strategies such as rewards and social comparison. Sometimes points were a reward that could be accumulated and maybe traded for something such as:

"…trade your points and get something back, which is your reward." (19/109#4)

Māka can also be an expression of experience: The following participant is recalling his experience playing the computer game *Farmville*, he is talking about how points are allocated for completing specific tasks and how those points accumulate and are then used to increase a players in-game level.

It is interesting to note that although the mechanics are presented individually, participants frequently discussed māka in combinations such as points and levels, as in this extract. This comment underpins the dynamics of game progression: Māka are awarded for completing specific in-game behaviours, and these points are accumulated, then at a certain number of points the player increases rank by advancing to a new level.

> *"Yeah, you know the number of points you got would assume your level. And you know when you get high points, mastery I think it's called, then you'd go up another level.' (19/285#3)*

This extract demonstrates the link between māka, and other mechanics such as levels which lead to an increase in player ranking.

6.3.1.4 KŌEKE – LEVELS

Kōeke are a series of stages of increasing difficulty, a player may progress through these stages, completing each before advancing to the next. Participants clearly understood the link between accumulating points and progressing through a game as demonstrated in this extract:

> *"I feel like most games, and you know, old school games, it's levels, you know what level you're at." (19/285#1)*

The following extract explores how the construct of levels could be designed into a health behaviour change intervention. This links levels with a feedback mechanism:

> *"If you want to compare how you're going in terms of health, from now to when you started, then you're going to need some sort of measuring system." (19/109#4)*

This study also finds a strong link between kōeke and social comparison as it allows people to compare their level against other people. This is demonstrated in the following extract where the participant is explaining to another participant the meaning of social comparison:

> *"We're talking about whakatauranga [ratings], kōeke, anything that sort of stakes you up against the others." (19/109#4)*

So, as well as being representative of the player's current status, levels are also a useful way to determine how an individual compares to other individuals, or in the case of this study how one group might compare against another.

6.3.1.5 PAPA TĀTAI – LEADERBOARDS

Papa tatai is a visual representation of a scoreboard that shows the names and current scores of the leading competitors. Typically, in the case of gamification, these scores are experience points or ratings awarded to a user for completing tasks. Participants suggested that papa tātai are useful in two ways: they support the persuasive strategy of competition by showing which player or group of players is in the lead, and papa tātai also support social comparison in that they allow a party to compare their own performance against the performance of others.

The following extract comes in response to the question: *How do you think we could represent comparing yourself or your group to others?* This question is specifically asking participants to generate ideas using the mechanics cards for each of the persuasive strategies they had previously identified would be motivating:

> *"I really like [leaderboards] because you can see it when you're working out, you can see on the board so they have it at my gym. At the end of the week you can see who's the leader, who's in front so it's really good." (19/310#1)*

Participants in hui 19/310 had identified social comparison as an important aspect of motivation, in this instance the participant is discussing that her gym provides electronic monitoring of member's physical activity awarding effort points for intensity, duration, and heart rate. These points are accumulated and displayed in the gym on an electronic leaderboard in real time. This type of leaderboard increases physical activity because users compare their own score to others, and often attempt to improve their own scores by increasing their effort during their workout. Participant 19/310#1 also mentioned that when she observed her leaderboard score was close to the next person in front of her, she frequently put in extra effort by working out a little longer or by increasing the intensity of her workout.

6.3.1.6 WHAKATUTUKITANGA – ACHIEVEMENTS

Whakatutukitanga represents a task completed successfully with effort, skill, or courage. While participants in this study did mention achievements, typically it was linked with other mechanics such as challenges or levels as demonstrated in the following extracts:

"Whakatutukitanga, achievements, I like achievements. So, you acquire those, then you could get something. Levels are also an achievement; you've reached a certain point." (19/109#1)

This first participant viewed achievements as being something they could acquire and furthermore, that their acquisition would transfer into some other value such as a reward.

"I think whakatutukitanga [achievement] and wero [challenge] could be Mahi Tahi [cooperation], so, you're working together to achieve something." (19/109#4)

The context of this second extract is that the participant is saying that the persuasive strategy of cooperation, that is, working together to achieve a common goal, can be supported by mechanics such as achievement and challenges. There are perceived similarities between whakatutukitanga and wero (challenges) in that wero are the missions followed in a game by the player, and achievements are the successful completion of tasks and challenges.

6.3.1.7 WERO – CHALLENGES

Wero are a mission followed in game to complete a prescribed task; therefore, a series of prescribed tasks can be a useful way to highlight future steps. Wero is a provocative word which often means an invitation to participate in a show of superiority in relation to ability or physical strength. Participants perceived that wero relates to both cooperation and competition. Wero are also about setting goals, both for the individual, and for groups. The following extract illustrates that participants perceived that wero have a role in creating incentives for users to complete specific in-app tasks:

"Yeah, wero, because that gives you some kind of incentive to get there eh? It's good as a group if you were doing this as a group because you were supporting each other. Yeah now you got to climb another mountain by Friday. I'll do it, better get the reward though." (19/109#1)

The extract is interesting because it demonstrates wero are related to cooperative behaviours, but also, that participants perceived that wero are specifically related to rewards. This shows that were have multiple purposes in application design and should be utilised in conjunction with other game design elements to support various persuasive strategies.

6.3.1.8 WHAKATAURANGA – RATINGS

Whakatauranga were perceived as a form of social comparison, that is, to allow a user to compare their performance, status, or achievements against other users. This is different than my own interpretation which is a player valuation based on the assessment of quality, standard or performance such as when a player evaluates the quality of an experience, for example: rating an accommodation experience on *Trip Advisor*. However, participants perceived whakatauranga as a representation of ranking, similar in many respects as levels or leaderboards. An example of this is shown in the following extract:

> *"We're talking about whakatauranga [ratings], kōeke [levels], anything that sort of stakes you up against the others." (19/109#4)*

This extract potentially shows that either the mechanic was poorly understood, poorly explained, or that participants did not perceive the difference to be substantial. Not all mechanics received the same amount of discussion signifying that some mechanics may be more useful than others.

6.3.1.9 WHAKATANGATA – AVATARS

Whakatangata are player avatars or a digital representation of self, in video games they manifest as icons or figures which indicate the player's persona. While whakatangata are common in video games, participants indicated a strong link between avatars and customisation. The following conversation is between two participants attempting to explain how the popular online video game *Fortnite* implements customisation options for players by rewarding achievements with *skins* which are a form of avatar customisation. In *Fortnite*, skins have no impact on gameplay dynamics but may have an impact on how other players perceive and interact with the player and therefore they are a popular form of expression in-game:

> *"Yeah, with Fortnite, that's what they do. You can change your avatar. I haven't played the game, but... (19/285#3)*

> *"And it's an incentive. Whenever you progress in the challenge you get those new skins. And in the last, the very last challenges, are the most rare. And that's an incentive for people to get those [skins] because it's rare." 19/285#2*

Avatars may be a useful form of self-expression in an application, allowing a user to feel more connected to the character, particularly with relation to how other players or users perceive the avatar. This suggests that whakatangata need to have some form of

public visibility to be effective, and furthermore, that users could customise, or personalise the avatar.

6.3.1.10 PAKIWAITARA – NARRATIVE CONTEXT

Pakiwaitara is the narrative or story woven into the context of a game. An example of this is in the popular video game *Fortnite*, the background story is that players need to work together to defend themselves against invading alien-zombies. Typically, in health behaviour change interventions, there is little contextual narrative. However, this study has found that pakiwaitara is important to Māori and is therefore likely to be important in the design of an effective intervention. Stories have a strong link to cultural identity and designing an intervention along the lines of traditional stories or journeys may be effective. Stories resonated for all participants and many spoke about different aspects of storytelling.

Māori have extraordinarily strong links to ancestors and whakapapa tells the story of the individual which precedes all other information.

> *"So, it's kind like an identity. When I was teaching some young people you know, rangatahi stuff, before they even introduced their names, and before they would say who they are, you know just to give them an example of how important identity and whakapapa is to them. Where are you from? Oh, this place? Okay I can bring this map up and I can show you exactly on the map where you're from. And in that small place, there's a moana, there's an awa, there are three marae. So which one of those marae do you connect to? And then, straight away in the room everybody goes 'oh you're from there, I'm from there' you know, and we can identify, before you even said your name, where you're from." (19/109#1)*

This extract is included because it demonstrates that the story of who you are as an individual is the absolute basis of identity within Māori culture, the sharing of where your whakapapa to tells the story of who you are, who your people are, and what your place is in the world. Therefore, designing pakiwaitara into an application is essential for Māori, and potentially unique to Māori.

Pakiwaitara was also mentioned in relation to communal activity and sharing the story about what the group is trying to achieve. This means that the communication of messages and purpose is important and needs cultural sensitivity, perhaps suggesting that storytelling, or sharing the narrative is a major consideration.

"When you talked before everyone having a common goal, that would be your waitara, pakiwaitara. So, a storyboard for the group, a pakiwaitara." (19/109#4)

The use of the word *storyboard* indicates a visual representation to support the message and suggests that imagery is important. Visual storytelling is also an important aspect in showing users the potential outcomes of undertaking target behaviours. This participant is saying that by allowing a person to visualise the possible outcomes of future behaviour may be motivating:

"I think simulation is pretty good. So, if you were to stay on this track and it says you'll get here [goal] within X amount of days for the weight loss example it's not a bad future thought kind of thing." (19/310#3)

Feedback and suggestion also leverage pakiwaitara (narrative context), that is, the idea that the story of the user is blended into the application. In the following excerpt, the participant is explaining that receiving feedback from the application about how he has made progress over time would be beneficial. He is also talking about the personal connections with other users, and how when exercising together their stories, or journeys merge. He is also suggesting that being able to see how far you have already come can be a motivating force. This participant was less interested in counting steps, and more concerned with connecting with other people undertaking active experiences together and then recalling those memories at a later stage.

"Building a story doesn't essentially mean you have to, the app gives you a story to follow, or you could build your own one, and that cooperation. You could say: I have a mate who's doing the same kind of workout as you and you can build this kind of workout narrative as such, using that as context to make your own story and then look back on it as well. So, you're sweet, you know? This month we did this [record of activity]. It [the record of the activity] could have links to other sites that you've walked around. It draws back on the memory of it too, which I reckon reinforces the story telling them things, so it's more about the journey than it is about the numbers." (19/310#3)

The concept of 'remembering how far you have come' was echoed by another participant:

"Yeah, if you were like oh you've lost your first 10 kgs or something, and it was like, remember where you were like two months ago. You know that would be cool. Or like, see how much further you can run now. Okay maybe you're doing an hour of exercise but... Under the personalisation one too with that narrative context are before and after

photos, things like that. Where you started so writing something of when you first started [compared] to now." (19/310#4)

In this excerpt the participant is discussing how feedback is useful to keep people on track. Furthering this idea, she is suggesting that keeping a record, diary, or journal of a health journey would be useful, such as in the use of before and after photos can be useful and adds to a person's own narrative.

This theme has explored the building blocks of gamification design and discussed participant's interpretations of ten game design elements previously identified in the literature. It has presented their ideas and some real-world examples of how these elements could be used. The next theme explains how combinations of these elements might be configured to support each of the strategies discussed in *Theme Three: Persuasive strategies.*

6.3.2 THEME FIVE: MATCHING STRATEGIES WITH MECHANICS

Theme Five: Matching strategies with mechanics presents findings relating specifically to how the various game mechanics identified in *Section 6.3.1: Theme Four: Game Design Elements* can be combined to meet the specific persuasive strategies presented in *Section 6.2.2: Theme Three: Persuasive Strategies*. The findings in this section address *Research Question 3: Which configurations of game design elements support specific persuasive strategies for Māori?* This section begins by explaining the combinations of game design elements that were considered appropriate by each hui. Subsections *6.3.2.1* to *6.3.2.4* present findings relating to target behaviour ideas described in the hui.

The persuasive strategy and matching game mechanic configurations for each hui are recapped in Table 6.7. The table shows that all hui prioritised both Mahi Tahi (cooperation), and Urupare (feedback); Hui 19/285 and Hui 19/310 prioritised Whakataetae (competition); Hui 19/285 prioritised Āhuatanga Urutau (customisation); and Hui 19/109 prioritised both Whakatauritenga (comparison) and Momoho (reward). Game mechanics are presented in this table to show commonalities between hui. Table 6.7 also shows that individual game mechanics may be appropriate in multiple contexts and therefore, often appear in several locations.

Table 6.7

Persuasive strategy and game mechanic suggestions by hui

Game Design Elements	Hui 19/285	Hui 19/109	Hui 19/310
Mahi Tahi (Cooperation) Strategy			
Wero – Quests	✓	✓	✓
Papa tātai – Leaderboards	✓	✓	-
Whakatutukitanga – Achievements	-	✓	✓
Māka – Points	✓	-	-
Kōeke – Levels	-	✓	-
Pakiwaitara – Narrative context	-	-	✓
Tohu – Badges	-	-	✓
Urupare (Feedback) Strategy			
Tohu – Badges	✓	✓	✓
Whakatutukitanga – Achievements	✓	✓	✓
Whakatauranga – Ratings	✓	-	✓
Kōeke – Levels	-	✓	-
Māka – Points	-	-	✓
Pakiwaitara – Narrative context	-	-	✓
Wero – Quests	-	-	✓
Whakatangata – Avatars	-	-	✓
Whakataetae (Competition) Strategy			
Māka – Points	✓	-	✓
Papa tātai – Leaderboards	✓	-	✓
Wero – Quests	✓	-	✓
Kōeke – Levels	✓	-	-
Tohu – Badges		-	✓
Āhuatanga urutau/ Customisation Strategy			
Pakiwaitara – Narrative context	✓	-	-
Whakatangata – Avatars	✓	-	-
Whakatutukitanga – Achievements	✓	-	-
Whakatauritenga (Comparison) Strategy			
Kōeke – Levels	-	✓	-
Papa tātai – Leaderboards	-	✓	-
Tohu – Badges	-	✓	-
Wero – Challenges/quests	-	✓	-
Whakatangata – Avatars	-	✓	-
Whakatauranga – Ratings	-	✓	-
Momoho (Rewards) Strategy			
Tohu – Badges	-	✓	-
Whakatangata – Avatars	-	✓	-

The following subsections present four target-behaviours identified from the hui transcripts: Increase physical activity; Climb a mountain (figuratively); Sharing produce locations; Eating healthy foods. It should be noted that these target behaviours came from participant's discussions and were later developed into the wero (quests) that will be discussed in *Section 7.4: Implementing Game Design Elements*. Not all quest ideas were discussed in all hui. In *Section 7.4*, each wero (quest) will be considered from the basis of how separate persuasive strategies might drive decisions for game design element implementation. This section simply presents the target behaviours found in the data.

6.3.2.1 TARGET BEHAVIOUR: INCREASE PHYSICAL ACTIVITY

A common idea across the entire dataset was using technologies to increase physical activity. There are multiple examples from all hui including tracking mountain biking activities, increasing consistency of gym attendance, and improving the duration of gym performance, as demonstrated in these extracts:

> *"The one I used was Map My Run and it had mountain biking [and] all sorts. I liked it at the time […] I'd just like to track what I was doing at the time" (19/285#1)*

> *"Maybe an alarm goes off at 5:30 that says your gym starts in 15 minutes." (19/109#4)*

> *"It's an app and it goes with the MyZone belts. I really like those because you can see it when you're working out, you can see on the board." (19/310#1)*

One aspect these three extracts have in common is that in all cases participants are discussing how they use, or have used in the past, health technologies to support increasing their physical activity.

Several participants mentioned that walking 10,000 steps a day was a known healthy behaviour. In the following extract, the participant is talking about using health technologies to encourage whānau to increase their physical activity. He is talking about his māmā (mother) who was actively trying to reach a step-goal:

> *"You know you got these goals of 10,000 steps or whatever that would be quite motivating for her. I noticed that Māmā was getting up and going for a walk in the morning. Or then she got a standing desk, so, that would count as well, you know, just movement. You get to the end of the night or whatever, and you've only got 8,000 steps, then she would walk around the house or whatever." (19/285#3)*

These extracts demonstrate that in all hui, participants had ideas about increasing physical activity, and that there were multiple examples of technologies that supported these activities.

6.3.2.2 TARGET BEHAVIOUR: CLIMB A MOUNTAIN (FIGURATIVELY)

The idea of climbing a mountain is used metaphorically to describe the use of significant challenges to keep people motivated and engaged. This notion was common across all hui. In this following extract, the participant is discussing that a major challenge such as climbing a mountain could be achieved by people completing it in sections and working together to support each other:

> *"I'll go halfway up the mountain. You meet us halfway there. Hāere mai! Come on! A little encouragement." (19/109#1)*

The idea of having a significant challenge that could be broken into smaller sections is the basis of the mountain quest idea. The name of this quest is *Whāia te iti kahurangi*, which is explained by one of the participants:

> *"Essentially, it comes from a well-known whakataukī [proverb]: Whāia te iti kahurangi, ki te tuohu koe, me he maunga teitei, which means to aim for the highest peak and if you do not achieve it, let it be to another more lofty mountain." (19/285#3)*

The purpose of the wero (quest) is to set a challenge that extends the capability of the individual or group. The goal must be achievable, but not easily.

6.3.2.3 TARGET BEHAVIOUR: SHARING PRODUCE LOCATIONS

As previously discussed in *Section 6.1.1.3: Knowledge sharing*, participants in this study described a perception that Māori may like to share information, knowledge and resources with their community. This study also found that some Māori people would not take advantage of information for themselves; rather, the over-riding drive was to share information with other people. Participants across two hui suggested that increasing the consumption of fruit and vegetables would have a positive impact on health, but also recognise that affordability of fresh produce was often a challenge for Māori and is frequently a barrier to making healthy food decisions, as evidenced in these extracts:

> *"Yeah the other thing also is price. It's really expensive for food, it's really expensive. […] Where would be the best, cheapest kind of vegetables for the season." (19/285#1)*

> *"It's sort of like, for Māori who are on a budget. It can suggest a cheaper meal, or cheaper places to shop." (19/310#2)*

In both these extracts participants are discussing sharing their knowledge of low-priced fruit and vegetables with other people. Specifically, they were discussing using technologies such as *Gaspy* (an application for sharing low fuel prices) to improve accessibility to healthier food choices.

6.3.2.4 TARGET BEHAVIOUR: CHOOSING FRUIT AND VEGETABLES

As previously discussed in *Section 6.2.1: Underlying Beliefs*, participants recognise the benefits of making healthy eating decisions. The following participants are responding to the question *what does healthy eating look like to you*?

> *"Well, one of the things we notice changing seasons, so obviously summer is salads and then get into the colder months we have then the vegetables type stuff. [...] If there was something in the app that gave me a heads up that, this [suggested vegetable] is in season, and [suggest that] you should look for this" (19/285#2)*

> *"…everyone knows what not to eat and what to eat and we all eat bad food and we know what to drink." (19/285#1)*

These extracts demonstrate that participants have perceived beliefs relating to ideas of healthy eating choices. They are open to the suggestion that an application that encourages them to eat seasonal fruit and vegetables may be beneficial. Therefore, this functionality may support positive eating goals. It is clear from these extracts that participants clearly have knowledge about what healthy eating is. The participant in the following extract has similar ideas, but links this to technologies by talking about putting her goals into place. In this instance, participants were discussing recording their food choices in a food diary to track their behaviour:

> *"Just even eating. You might eat crappy one week but then putting those goals in place where you can achieve, easily achieve, and then the next week you might eat a bit better." (19/310#1)*

This was a common thread in the hui with multiple participants demonstrating that making healthy food choices contributes to improved health outcomes and that there is a role for technology in supporting these healthier behaviours.

6.4 CHAPTER SUMMARY

This chapter has presented the findings of *Phase One: Co-Design Hui* and provides some insights into ways that a gamified application could be designed to encourage Māori to be more active and to make healthier lifestyle choices. *Theme One: Māori social context*

stated that in Māori society, whānau (family) have a strong impact on an individual's behaviour and the perceived expectations of referents has a direct impact on an individual's motivation to comply with a specific behaviour. This theme explores factors such as collective-thinking and a generosity mindset which appear to be important to the participants. A generosity mind-set manifests through a willingness to develop and share knowledge and resources. This is demonstrated in the willingness to develop an application that benefits the wider community, and for application users to contribute their own knowledge or experiences into a database that would benefit others, such as in the case of user-generated content about seasonally available produce within a specific location. This study also found that some Māori have a sense of being a collective and having a collective-thinking mind-set which embodies the idea that some Māori work together for the benefit of the collective, rather than the individual person. Interestingly, Māori individuals may perform a behaviour they are reluctant to adopt if they perceive that the wider whānau will benefit from the action, and therefore, this signifies that whānau involvement is an important design consideration.

Theme Two: Underlying beliefs showed that, in general, participants agreed with previous research that mobile devices are an acceptable way to deliver health care initiatives, and that participants believed that such a device would support them on a journey to make positive lifestyle changes, and that they personally had the skills to use such a technology. The study found that in general participants could identify key behaviours that might support a healthy lifestyle such as increased physical activity and avoiding high-calorie beverages. Participants were vocal on the idea that committing to a healthier lifestyle was beyond the scope of any technology, and believed that motivation to make changes was internalised, but could be triggered by an event such as a health scare. Participants clearly had beliefs about the type of support that could be delivered via a mobile device and suggested that some of a phone's in-built technologies would support them to make lifestyle changes. Interestingly, participants across the dataset expressed the idea that they believed that they possessed control over the factors that may inhibit adoption such as device and data accessibility, and an ability to complete challenging tasks. Finally, this study also identified that devices were support tools, and could not replace the need for self-motivation and beliefs about the benefits of setting and attaining lifestyle goals.

Theme Three: Persuasive strategies discusses persuasive strategies are frequently found in information technologies such as mobile applications and computer software, and as such, may be considered motivating factors of engagement and continued use intentions

for any software. This study found six persuasive strategies that would be effective in the context of a Māori health behaviour change intervention: whakataetae (competition), mahi tahi (cooperation), whakatauritenga (comparison), āhuatanga urutau (customisation), momoho (rewards), and urupare (feedback).

This study found that whakataetae exists in two forms: intra-whānau rivalry, and inter-whānau competition. It also found that the higher the degree of personal relationship an individual has to other people using an application, the lower the emotional response or sense of competitiveness the individual may experience, and therefore the lower likelihood that competitive persuasive strategies will affect user's motivation. Conversely, the lower the degree of personal relationship an individual has to other people using the application, the higher the degree of competitiveness they may feel and therefore, the higher the likelihood that competitive strategies will impact user's motivation.

Mahi tahi suggests that some Māori are motivated to work collectively to achieve a common goal, and that mahi tahi is an important component of Māori social orientation. Moreover, this study found that the higher the degree of personal relationship an individual has to other people using the application, the higher the intensity of the sense of cooperation, and the preference for cooperative strategy, and additionally, that they will experience higher levels of motivation and commitment to achieving shared goals collectively.

Whakatauritenga (comparison) is a persuasive strategy that suggests that when an individual can see and compare their current performance against the performance of others, this visibility will challenge them to improve their performance or strive to achieve their personal goals. Whakatauritenga requires a form of comparative visualisation such as statistics or leaderboards and as such, is a form of social orientation which underpins both whakataetae and mahi tahi.

Āhuatanga urutau is important from two perspectives: Māori-centric design, and individualisation. Specifically, in addition to being designed using tikanga Māori principles (cultural protocols), an application needs to be adaptable to meet the needs of the individual user including elements of customisation around notifications and information, but also around user-centric choices about activities and programmes.

Momoho are given in an application as a celebration of achieving a significant goal, and the reward itself should motivate the user to keep working to complete a target goal,

which in this context might be system-programmed desired behaviours, or user-selected target outcomes. Momoho are an important aspect of motivation and encouragement.

Urupare consists of two forms of feedback: evaluation and coaching. Evaluation feedback takes the form of an appraisal of the user's current health or performance data in comparison to previous performance data; and coaching feedback takes the form of mentoring or coaching with an aim to make incremental improvements over time.

Theme Four: Game design elements explores the building blocks of gamification design from the perspective of participant's interpretations of ten game design elements previously identified in the literature. This study found that combinations of individual game mechanics is contextual and is strongly linked to persuasive strategies. Therefore, the focus should be on the specific persuasive strategy, rather than on the individual game mechanics. This study also suggested that game mechanics should be viewed as a toolbox, and that the appropriate mechanic depends on the unique design context.

Theme Five: Matching strategies with mechanics explained how participants perceive that game design elements combinations may be efficacious in supporting the previously identified persuasive strategies. It combines findings from themes three and four with interpretations and aggregations of data to provide specific examples about how the combinations of persuasive strategies and game design elements might be operationalised in a Māori-centric health behaviour change intervention. Discussion on each of these findings is presented in *Chapter Seven*.

CHAPTER SEVEN: PHASE ONE DISCUSSION

This chapter discusses the findings from *Chapter Six* in relation to extant literature and the theoretical framework adopted for the current research. The overarching research question is: *How can gamification be used in Māori mHealth applications*? The aim of this research is to understand the key contextual elements that shape Māori health, to identify which persuasive strategies are effective in a gamified physical activity and diet intervention for Māori, and to determine which configurations of game design elements support specific persuasive strategies for Māori. The discussion in this chapter leads to the development of a design artefact that will be tested and evaluated in Phase Two.

Section 7.1: Understanding Māori Social Context relates the findings of this study to the normative beliefs theoretical construct and discusses beliefs about the perceived expectations of referents and their impact on motivation to comply with health behaviour change. *Section 7.2*: *Underlying Beliefs* discusses behavioural beliefs and control beliefs as described in the RAA theoretical framework. It also discusses some underlying beliefs about a health behaviour change application and whether individuals perceive such an application would be beneficial to them. *Section 7.2* also discusses beliefs about an individual's ability to control factors that may facilitate or inhibit their adoption of an application. Additionally, the concept of motivation, and how this relates to behavioural beliefs and behavioural intentions is discussed.

Sections 7.3: *Persuasive Strategies* relates the findings from *Chapter Six* to the extant gamification literature and contributes to gamification design literature within an Indigenous context. *Section 7.4: Implementing Game Design Elements* discusses how theoretical constructs and findings from this research can be combined to support specific target behaviours and persuasive strategies design a non-interactive prototype. *Section 7.5: Artefact Design* summarises the activities undertaken to complete the storyboards. Finally, this chapter concludes by identifying further research gaps from Phase One that will be addressed in Phase Two.

7.1 UNDERSTANDING THE MĀORI SOCIAL CONTEXT

Understanding the Māori social context is critical for designing targeted health behaviour change interventions that specifically meet the needs of the target audience (Ni Mhurchu et al., 2014; Te Morenga et al., 2018). This approach is advised by multiple gamification researchers such as Khaled (2008), and Oyibo and Vassileva (2019). Discussion in this section allows us to address RQ1 which asks: *What are the key contextual*

elements that shape Māori engagement in health behaviour change? Findings presented in *Chapter Six: Phase One Findings* show that the Māori social context is unique; specifically, it explains that in Māori society, whānau (family) may have a strong impact on an individual's behaviour. Social norms, such as perceived whānau expectations, impact an individual's motivation to comply with those expectations.

7.1.1 WHĀNAU EXPECTATIONS

Participants in this study discussed three important dimensions of accountability (see *Section 6.1.1.1*) which relate to the beliefs an individual has regarding the expectations of their own referents: *internal accountability* relates to self-motivation; *whānau accountability* extends to the perceived expectations of friends and whānau; and *external accountability* is the perceived expectations of influential service providers such as personal trainers or exercise referrers. There appears to be a relationship between internal accountability and self-motivation, and therefore, this concept was described in *Section 6.2.1.3: Self-Motivation*. Whānau and external accountability can be likened to the theoretical construct *normative beliefs*, which was previously presented in *Section 2.4*: *Health Behaviour Change Theories in Gamification*. A more detailed account is given in the following paragraphs.

The Reasoned Action Approach (RAA) theorises that normative beliefs directly impact an individual's motivation to comply with perceived behavioural expectations and that normative beliefs are determinants of behavioural intention (Fishbein & Ajzen, 1975). Normative beliefs comprise two components: *referent norms* and *motivation to comply with referents* (Gillmore et al., 2002). The current research contributes to knowledge by explaining that the strength of normative beliefs has a major impact in Māori society. In the current study, referent norms can be described as: *what does the individual's whānau (family) think they should do;* and motivation to comply with referents can be described as: *how much does the individual want to do what their referents expect*.

The current research has found that the perceived expectations of referents such as friends and whānau significantly influence an individual's behavioural intention to begin a health behaviour change programme, and that perceived whānau expectations have a substantial impact an individual's motivation to comply with a health behaviour-change programme. This finding is consistent with Reasoned Action theorists such as Ajzen (1991, 2012, 2020), Fishbein and Ajzen (1975, 2011), and Fishbein and Yzer (2003).

The perceived expectations of whānau manifest as *accountability* and participants stated that they believed that referents such as whānau would hold them accountable if

they decided to undertake a health behaviour change programme. Previous studies have shown that personal accountability and the influence of referents such as healthcare professionals has a positive impact on actual behaviour, and accountability has a direct impact on self-efficacy (Liddy et al., 2015). This study also found that a lack of peer pressure can have a negative impact on behavioural intentions, with participants describing that the absence of accountability would be demotivating. This suggests that the more an individual believes others think they should perform a specific behaviour, then the more that individual is motivated to comply with the referent's perceived expectations, and the stronger the behavioural intention (Fishbein & Yzer, 2003).

7.1.2 FOR THE BENEFIT OF ALL

Another dimension of the Māori social context is that participants is the perception that Māori may more motivated to undertake a behaviour change programme when they perceive that whānau members are the *beneficiary* of such a behaviour, meaning that they are more likely to engage in health behaviour change when it supports others and when others benefit from the activity (see findings in *Section 6.1.1.2*). Furthermore, Māori may perform a behaviour they are reluctant to adopt (such as healthier food choices) when they perceive that their whānau will benefit from the action. This finding points towards the notion that some Māori hold a collectivist orientation. Hofstede (1994) stated that collectivist societies focus on *we*, in contrast to individualistic societies that focus on *I*. A collectivistic or individualistic orientation may account for cultural variation in behaviour (Hofstede, 1980). Hook (2007) contend that collectivistic peoples, such as Māori, stress the importance of "relationality, collectivity, reciprocity, and connectivity" (p. 4). In contrast, Pākehā (New Zealand Europeans) value "autonomy, freedom, self-interest, entitlement, [and] competition" (p. 4).

It has been argued that Māori self-identify as holding a collectivist perspective (Brougham et al., 2015), this suggests that the collectivist orientation may be an important dimension of the normative belief system in Māori society. The current research indicates that some Māori might prefer to work cooperatively to achieve group goals particularly when the group members are known to each other. Earley (1989), noted that the concept of cooperation is a driving force in collectivist cultures, and Brougham and Haar (2013), stated that collectivism underpins "cooperation towards accomplishing group goals" (p. 1145). Therefore, this indicates cooperation might be a critical design aspect in the prototype design.

7.1.3 KNOWLEDGE SHARING

Further to the notions of normative beliefs and a collectivist orientation in Māori society, this study also found that some Māori have an inherent willingness to share information, knowledge, and resources with their wider community for the betterment of other people (see *Section 6.1.1.3*). This finding is consistent with Haar et al. (2019), who stated that generosity is a personal value reflected in the Māori principles of "manākitanga [taking care of others] and ko tau rourou [generosity of spirit]" (p. 624). In this context, ko tau rourou also refers to helping others in a non-material way to enable the betterment of others. A notion that may be likened to the western concept of *altruism* (Haar et al., 2019).

Section 7.1: Understanding Māori Social Context, goes part of the way in answering RQ1, which asks: *What are the key contextual elements that shape Māori engagement in health behaviour change?* It discusses aspects of Māori society that are unique, namely, that some Māori self-identify as having a collectivist orientation, and this orientation mediates normative beliefs and an individual's motivation to comply with the perceived expectations of referents. It has shown that social values such as Mahi Tahi (cooperation), manākitanga (caring for others), and ko tau rourou (generosity) are inherent in Māori society, and furthermore, that these social values impact normative beliefs, which in turn have a mediating effect on behavioural intention. The next section discusses underlying beliefs about the perceived benefits and usefulness of health behaviour change technologies. It also discusses the notions of self-efficacy and motivation, and how these concepts relate to behavioural beliefs and behavioural intentions.

7.2 UNDERLYING BELIEFS

This section discusses three key aspects of behaviour change theory: outcome beliefs, control beliefs, and motivation. It compares findings from *Section 6.2: Research Question Two,* to the extant literature to show that an individual's perceptions of health behaviour change technology and lifestyle decisions impacts their attitude toward undertaking activities that support these outcomes. It discusses findings relating to behavioural beliefs, control beliefs, and motivation.

7.2.1 BEHAVIOURAL BELIEFS

This subsection discusses the findings in (*Section 6.2.1*). The RAA theorises behavioural beliefs directly impact an individual's attitude toward a specific behaviour, which mediates their intention to perform that behaviour (Ajzen et al., 2018). Fishbein

and Ajzen (1975) stated that attitudes are the learned predispositions individuals have toward behavioural intentions, rather than towards the actual behaviour itself. In this case, attitude should be defined as a predisposition to evaluate a behaviour with some degree of favourableness or unfavourableness (Ajzen, 2012). Attitudes are informed by beliefs which represent the information an individual has about an object and its associated attributes (Fishbein & Ajzen, 1975); and a belief is the "subjective probability that the object has a certain attribute" (Ajzen, 2012, p. 12). This subsection discusses some of the underlying beliefs identified in this study.

This study found that in general, participants believe that mobile health applications would be beneficial to them and lead to positive health outcomes. In prior research, Gorton et al. (2011) stated that some Māori participants believe smartphones are an appropriate vehicle for delivering healthy lifestyle interventions. The current research also found multiple examples of specifically how smartphones could be effective in health behaviour change interventions, as many of a smartphone's embedded sensor technologies such as location sensing, microphone, camera, compass, and accelerometers could be leveraged within the design (Fitz-Walter, 2015; Lane et al., 2010).

Another related finding in the current research is that health and fitness applications are perceived as useful support tools for health behaviour change. Applications containing functionality such as reminders, notifications, activity tracking, and suggestions for ways to make healthy lifestyle adjustments are examples identified. This finding is comparable to Ni Mhurchu et al. (2014), which showed that design elements commonly requested by users include: message personalisation; real-time informative text messages; culturally appropriate language; social support; and weight tracking functionality.

Ni Mhurchu et al. (2014) also established that the core components of an evidence-based health behaviour change intervention should include: "self-monitoring of behaviour; prompting intention formation; promoting goal-setting; providing feedback on progress; and prompting review of behaviour goals" (p. 2). Previous studies have shown that users believe mHealth applications are useful for supporting positive health behaviours including weight-loss (Ni Mhurchu et al., 2014), and this finding is particularly relevant for Māori (Gorton et al., 2011).

The adapted RAA framework implemented for this research shows that behavioural beliefs influence attitude, and that technology beliefs about ease of use and perceived usefulness mediate attitude (Davis et al., 1989). The implications for design are that the inclusion of features that users deem important translates directly into *Perceived Usefulness*,

and therefore will likely positively influence attitude, and indirectly influence behavioural intention.

7.2.2 CONTROL BELIEFS

Control beliefs are the beliefs an individual has about the presence of factors that may facilitate or impede their performance of a specific behaviour; and *perceived behavioural control* is the perceived degree of ease or difficulty required to overcome any barriers (Ajzen, 1991). This subsection relates to the findings presented in *Section 6.2.1.2*. There is no conceptual difference between perceived behavioural control and Bandura's concept of *self-efficacy* as both refer to an individual's belief that they can perform a target behaviour (Ajzen, 2020).

This research found that participants believe they could make healthy lifestyle changes and agreed that they personally felt that health behaviour change was within their own abilities *if* they chose to undertake it. Furthermore, they perceived that technology would be useful to support health behaviour change and that they believe they possess the skills to use mHealth technologies. As previously discussed in *Chapter 2.2.3*, Davis et al. (1989) contend that behavioural intention is directly mediated by an individual's attitude toward using the target technology, and further stated that attitude is jointly influenced by *Perceived Usefulness* and *Perceived Ease-of-Use*. Perceived Usefulness is widely interpreted an individual's perception that a technology will be useful to them within their specific context; and Perceived Ease-of-Use generally means the degree to which the individual expects the technology to be free of effort (Davis, 1989).

These theoretical constructs inform the prototype design by highlighting that an mHealth platform may be appropriate for the delivery of a health behaviour change intervention in a Māori context. Furthermore, users of such a technology expect the technology would facilitate their programme adherence, and correspondingly, that an mHealth technology would be both useful, and relatively easy to use.

One barrier to technology adoption identified in this study relates to contradictory experiences regarding data connectivity. Although participants perceive that access to smart devices is not an issue for Māori, most participants report being unwilling to use mobile data from their devices, rather, they expect to be able to connect to Wi-Fi for free from almost any location and they report being adept at finding central points of connection such as schools, libraries, and telecommunications provider hotspots. Although all participants stated that they personally had access to Wi-Fi at home and via

public hotspots, they indicated that a portion of the Māori population had little access to Wi-Fi at home, particularly Māori youth and people residing in remote or rural locations.

This finding appears to contradict a report from Statistics New Zealand (2013), which showed that 92% of New Zealand households had access to a mobile phone; that internet access is available by 80% of the population; and further, that ethnicity or age accounted for little difference across the entire population. Interestingly, Statistics New Zealand (2018) reported that mobile phone internet connections increased 151% between June 2015 and June 2018. More recent reports show that internet access for Māori is lower than non-Māori, and there is less internet accessibility for people who live in social housing and for people who identify as disabled (Digital.govt.nz, 2019). These are both statistics in which Māori are over-represented. Overall, 87.13% Māori have internet access at home compared with 90.36% for the whole population (Digital.govt.nz, 2019).

The implications for a prototype design are that mobile connectivity and internet access may not be ubiquitous for Māori. However, this may not necessarily inhibit technology adoption, as locating a data connection is within an individual's control for many Māori. A design consideration is for an mHealth application to use as little data as possible, and for the application to also work offline, provided users can connect to an internet connection occasionally.

7.2.3 MOTIVATION

This study found a link between motivation and behavioural intention, findings relating to this relationship were presented in *Section 6.2.1.3*. One of the criticisms of behaviour change theories such as the Reasoned Action Approach, is their inability to explain motivation, or behaviour triggers as antecedents for behavioural intentions (Pinder et al., 2018). Yet, understanding what motivates users to engage with technologies is a critical element of gamification design (Nacke & Deterding, 2017). There is complete agreement from participants that unless an individual has formed the behavioural intention to make lifestyle changes, an mHealth application would have no impact on motivation. Yet there is evidence from previous studies that Perceived Usefulness and Perceived Ease-of-Use of technology have a positive impact on user attitudes, and indirectly on intentions to use the technology (Davis, 1989; Rajani et al., 2021; Rodrigues et al., 2013). These previous studies suggest that if an individual had expectations about the efficacy of an application, and they perceive that the application would support their behavioural goals, then this may have a positive impact on behavioural intentions.

There are two dimensions of motivation identified in this study: *motivation to comply* with the perceived expectations of referents; and *self-motivation*, which in this context refers to an individual's decision to make healthy lifestyle changes. Participants generally agree that the intention to adopt and adhere to a health behaviour-change programme begins with the individual deciding to make a lifestyle change, and that there are a multitude of behavioural triggers. It has been argued that motivation in this context is a stage in the process of "forming of behavioural intention followed by volition" (Berger & Schrader, 2016, p. 6). Furthermore, Lienert and Patel (2020) found that perceptions about behaviour, and actual behaviour changed based on the frequency of exposure to referent groups. This suggests that frequent exposure to referent pressure may influence both beliefs about a technology, and its eventual adoption more than participants expect.

Previous research has found an association between motivation and self-efficacy specifically in gamified technologies. Studies show that communication designed to increase self-efficacy may also lead to increased motivation, and therefore may increase the likelihood of successful behavioural performance (Rajani et al., 2021).

Section 7.2: Underlying Beliefs has discussed that generally, participants believe that mHealth applications are beneficial to support health behaviour change, and this may also be the case for Māori. The unique social context for Māori suggests that social influence is an important design consideration and therefore, that the prototype design should recognise cooperative behaviour may align more closely with Māori social values. *Section 7.2* addressed RQ1, which asks: *What are the key contextual elements that shape Māori engagement in health behaviour change?* This section has shown that health behaviour change interventions may be useful tools for supporting healthy lifestyle programmes, and the inclusion of user requested features such as personalisation, real-time information, social support, and progress tracking, may have a positive impact on the Perceived Usefulness of such a technology. In line with previous research, this study shows that technology beliefs have an impact on both attitude toward the technology and behavioural intention. Evidence-based health behaviour change research determined that self-monitoring, reminders, goal setting, and feedback are essential design elements are useful for supporting adherence to health programmes such as weight-loss, and that Perceived Usefulness has an indirect impact on behavioural intention. The next subsection discusses persuasive technology design strategies and how the findings of this research contribute to knowledge about the use of persuasive strategies to facilitate health behaviour change in Māori.

7.3 PERSUASIVE STRATEGIES

Persuasive technologies such as gamified health interventions are an effective way of motivating health behaviour change using various persuasive strategies (Orji et al., 2019) without using coercive or deceptive tactics (Lehto & Oinas-Kukkonen, 2011). Persuasion is a fundamental function of these technologies that attempt to influence an individual's attitudes, behavioural intentions, and ultimately their actual behaviour (Dadaczynski et al., 2017; Orji et al., 2019). Findings relating to persuasive strategies were presented earlier in *Section 6.2.2*.

One aim of the current research is to address RQ2: *which persuasive strategies are effective in gamified physical activity and diet interventions for Māori?* Previously presented findings suggest that culture and social context play an important role in persuasive strategy preference. Recent health-related research has shown that the collectivist/individualist cultural dimension might predict behavioural outcomes (Almutari et al., 2022) and therefore the nature of collectivism may be of significance to the current research also, particularly in relation to socially-oriented persuasive strategy preferences. Khaled (2008) stated that much of the extant literature on persuasive technologies originates from individualist countries, and therefore carries an inherent bias towards individualism, suggesting that persuasive technologies described in extant literature may be less effective on users from collectivist cultures, such as Māori.

7.3.1 WHAKATAETAE (COMPETITION) AND MAHI TAHI (COOPERATION)

Socially-oriented strategies such as Whakataetae (competition), Mahi Tahi (cooperation), and whakatauritenga (comparison) are the most commonly occurring persuasive strategies (Orji et al., 2019) in persuasive technologies, which may suggest they would also be the most effective (see *Sections 6.2.2.1* and *6.2.2.2* for findings). Whakataetae (competition) is commonly designed into persuasive technologies on the assumption that most people are competitive (Oinas-Kukkonen & Harjumaa, 2009; Orji, Nacke, et al., 2017). An early study into persuasive technologies by Fogg (2003) indicates that including competitive elements in technology design would motivate users to perform a target behaviour. However, this study found that this is not necessarily the case for Māori (see *Section 6.2.2.1: Whakataetae – Competition*).

One possible explanation for this contradictory finding is that there appears to be a relationship between the degree of personal connection that a user has with other users of a gamified application, and their preference for Whakataetae (competition) or Mahi

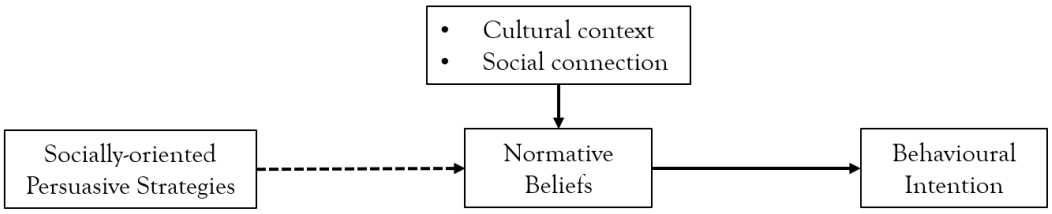
Tahi (cooperation) persuasive design strategies. An interesting finding in the current research suggests that some Māori are highly competitive in a team-versus-team environment, and less-competitive in a whānau environment. Additionally, there may be a perceived difference between *rivalry* and *competition* in Māori society and this affects whānau relationships. *Intra-whānau rivalry* is a form of friendly competition such as that which occurs between siblings and immediate whānau. This is distinct from *inter-whānau competition* which is serious in nature and occurs between separate whānau groups or unrelated persons. These findings contribute to knowledge about collectivistic cultures, and echo the previous findings of Khaled (2008); Takemura and Yuki (2007); and Triandis (1993).

Figure 6.1, previously presented in *Section 6.2.2.1*: *Whakataetae – Competition,* suggests a link between the degree of social connection between users and the degree of competitiveness they perceive they will prefer when using a gamified technology. These findings suggest that some Māori users may prefer a lower degree of competition against close social contacts and a higher level of competition with strangers. This study also presented a similar finding with respect to Mahi Tahi (competition): Māori will likely prefer a higher degree of cooperation with close contacts, and a lower degree of cooperation with strangers, as group interests outweigh the individual's interest in a collectivist culture (Almutari et al., 2022). Previous studies show that individuals in a collectivist culture undertake actions for the group's benefit (Triandis, 1993), so therefore, are more likely to prefer to work cooperatively. These findings suggest that persuasive strategy preference is moderated by social connection (Khaled, 2008).

The RAA shows an *indirect* relationship between distal variables and behavioural intentions as they are mediated by behavioural, normative, and (or) control beliefs (Ajzen, 2020). Abbasi et al. (2015) found that an individual's behaviour in a collectivist culture is closely related to normative beliefs, and motivational compliance. This finding appears to be similar to Brougham et al. (2015), who stated that the collectivist culture has an indirect relationship on the normative belief system in Māori society. This study suggests that the distal variables cultural context and social connection, may have a stronger impact on the antecedents of behavioural intention in a Māori social context. Figure 7.1 shows that the effects of socially-oriented persuasive strategies on behavioural intention are mediated by normative beliefs, and that the effect of normative beliefs on behavioural intentions are moderated by the influence of cultural context and social connection.

Figure 7.1

Social context as a moderator of normative beliefs



One of the challenges of discussing competition and gamification within the scope of Indigenous research is that there is very little extant literature that supports or negates these findings, and therefore this discussion draws from persuasive information technology systems rather than gamification literature. To date, very little research has been undertaken exploring persuasive strategy preference in collectivist cultures (Khaled, 2008). An exploratory study by Oyibo et al. (2017) found that in a collectivist culture, males and younger people are more persuadable than females and older people by *competition* and *reward* as persuasive strategies. However, that study did not consider *cooperation* as a construct, which means it has limited value to this research. More recently, Oyibo et al. (2019) found that individualists are likely to be susceptible to *competition*, and are unlikely to be susceptible to *cooperative* strategies; however, neither study explored the moderating effect of culture. In a related study, Oyibo and Vassileva (2019) found that people from collectivist cultures are more likely to be susceptible to *cooperation* than individualists, and that collectivists rank *cooperation* higher than *competition* on a scale from most to least persuasive features. Therefore, the current research extends knowledge about appropriate design strategies for collectivist cultures.

On the basis that previous studies suggest there is a relationship between collectivist cultures and a preference for cooperative strategies (Oyibo & Vassileva, 2019), the current research contends that an application designed to become more physically active and to make healthy food choices should prioritise Mahi Tahi (cooperation) over Whakataetae (competition). Discussion of *competition* versus *cooperation* contributes to gamification knowledge in two ways: firstly, it suggests that the current western view of gamification design is likely to be inappropriate in a Māori context; and secondly, it reinforces the idea that health behaviour change systems need to be designed for the specific needs of the target population (Eyles et al., 2016).

7.3.2 WHAKATAURITENGA (SOCIAL COMPARISON)

Whakatauritenga (social comparison) provides users with the opportunity to "view and compare their performance with the performance of others" (Orji, Nacke, et al., 2017, p. 1021). Whakatauritenga is not overtly a competitive strategy as it does not involve winning or losing (Orji et al., 2019), and *social comparison* does not involve a direct interaction with other users, thereby differentiating it from competition (Orji et al., 2019; 2017). There is no disagreement that *social comparison* is a socially-oriented persuasive strategy (Orji et al., 2019; Orji et al., 2014; Oyibo & Vassileva, 2019). However, while most studies treat *social comparison* and *competition* as two separate strategies (Orji et al., 2012; Oyibo & Vassileva, 2019), Orji et al. (2014) stated that *competition* and *comparison* were perceived as similar, and in fact belong together.

In contrast, this study found that while a relationship exists between Whakataetae (competition) and whakatauritenga (comparison), in that whakatauritenga drives Whakataetae, they are distinct concepts. This finding (*Section 6.2.2.3*) is similar to Fogg (2003) who stated that social comparison motivates users to perform better against people they perceive are similar to them. *Social comparison theory* (Festinger, 1954) asserts that people are motivated to compare themselves with others to evaluate their own performance, and that comparative evaluations will affect the individual's behaviour. Social comparison increases social influence and motivates people to change their own behaviour to adapt to normative expectations (Ajzen, 2012).

Most gamification research considers *social comparison* a fundamental design element, and Hamari (2013) concluded that while *social comparison* does not directly correlate with increased physical activity, users who monitored their own badges and achievements and also compared themselves with other users did demonstrate increased in-app activity.

Interestingly, Oyibo and Vassileva (2019) found that although *social comparison* was ranked and rated higher by collectivists than individualists, the difference was not statistically significant. In fact, *social comparison* was one of the least preferred socially-oriented strategies, as people with a collectivist orientation actually preferred *competitive* strategies to *social comparison* (Oyibo & Vassileva, 2019). This finding suggests that when prioritising socially-oriented persuasive strategies in a prototype design for Māori, Mahi Tahi (cooperation) should be prioritised over both Whakataetae (competition) and whakatauritenga (social comparison).

7.3.3 MOMOHO (REWARD)

The current research presented findings in *Section 6.2.2.5*, that *Momoho (reward)* is a result of the combination of two separate persuasive strategies that were previously identified in the literature: momoho (reward), and mihi (praise). Momoho (reward) is one of the most commonly operationalised strategies (Orji, Mandryk, et al., 2017) in gamified applications, as users receive virtual rewards for performing a target behaviour or reaching a milestone (Allam et al., 2015; Meixner et al., 2020; Orji et al., 2014; White et al., 2019). It has been argued that all gamification is fundamentally designed toward the attainment of target behaviours (Hamari et al., 2018) as, by design, user actions and in-app activities are rewarded through points, badges, avatars, and medals (Allam et al., 2015; Koivisto & Hamari, 2014). The literature is divided over whether the positive effect of gamified systems stems from gameful design which makes activities more intrinsically motivating (Deterding et al., 2011; Hamari, 2015), or from providing extrinsic rewards for performing target behaviours rather than making the behaviours more enjoyable (Hamari et al., 2018; Hamari & Koivisto, 2015b).

Rewarding target behaviour is a form of *operant conditioning* (Skinner, 1938, 1969) where the stimulus (reward) is paired with the response (target behaviour). Theoretically, rewarding the desired behaviour makes it more likely that the behaviour will be repeated (Pinder et al., 2018). This is the typical implementation of rewards within gamified health interventions. Meixner et al. (2020) found that inactive people responded to immaterial rewards such as points and badges for increasing physical activity; thus, suggesting that rewards are an important aspect of gamified health interventions.

Although Orji et al. (2014) and Oinas-Kukkonen and Harjumaa (2009) presented *rewards* and *praise* as separate persuasive strategies, the current research has determined that *praise* is either (1) a text-based reward for performing a target behaviour; or (2) a form of feedback to users on their current performance. Therefore, *praise*, in the form of words, images, sounds, or symbols (Orji, Mandryk, et al., 2017) in response to target behaviour completion, is considered a form of momoho (reward), and *praise* in the form of words, images, sounds, or symbols for the purposes of encouragement is considered a form of *feedback* and will be discussed in the next subsection.

There appears to be a relationship between momoho and other persuasive strategies such as Whakataetae (competition) and Mahi Tahi (cooperation), as these strategies are frequently operationalised through the implementation of rewards for completing achievements (Orji et al., 2014). This may be explained through the lens of *Social Cognitive*

Theory (Bandura, 1989), which stated that if individuals observe other people being rewarded for completing target behaviours, they are likely to also perform the behaviour and meet the referents' behavioural expectations (Meixner et al., 2020). As discussed in *Section 2.1.1*, an individual's behaviour both influences and is influenced by the individual's personal factors and their social environment (Bandura, 1989). This was illustrated earlier in Figure 7.1 which shows that the effects of persuasive strategy preference on behavioural intention are mediated by normative beliefs, and furthermore, that the effect of normative beliefs on behavioural intentions are moderated by the influence of cultural context and social connection.

As previously stated, momoho (rewards) are commonly operationalised persuasive strategies in information systems (Orji, Mandryk, et al., 2017), and this is especially the case in gamified systems. Studies show that rewards are highly motivating, yet little research has been conducted on the moderating effects of culture on preference. Oyibo et al. (2017) found that in a collectivist culture, males are more likely to be susceptible to *reward* than females, and that this difference was not found in an individualistic culture. More recently, Oyibo and Vassileva (2019) found that rewards are perceived to be less motivating in a collectivist culture than *goal-setting/self-monitoring* and *cooperation* strategies, and more motivating than *competition* strategies.

This suggests that in an application designed to support Māori health behaviour change, should prioritise Mahi Tahi (cooperation) above momoho (reward), and that both strategies should be prioritised over Whakataetae (competition) for a collectivist culture such as Māori. As discussed earlier this may not be the case for an application designed for the general population (Oyibo & Vassileva, 2019). This discussion of *rewards* contributes to gamification knowledge by highlighting that the operationalisation of persuasive strategies in health behaviour change interventions should be driven by the cultural needs of the target population, and that dominant western gamification designs are culturally inappropriate for Māori.

7.3.4 URUPARE (FEEDBACK)

Any interactive system provides a degree of interaction with users in the form of verbal or text-based commentary, and various techniques are implemented into technologies to persuade users toward completing desired behaviours (Oinas-Kukkonen & Harjumaa, 2009). Examples of these techniques include praise, reminders, suggestions, liking, and rewards (Fogg, 2003; Oinas-Kukkonen & Harjumaa, 2009; Orji et al., 2014). In *Chapter Two: Literature review* ten persuasive strategies were identified, and these formed

the basis of the strategies discussed during the co-design hui. In the literature, researchers such as Orji et al. (2014) describe *feedback*, *suggestion*, and *simulation* as separate persuasive strategies. However, the current research proposes that they are all perceived by users as technology-driven communications (see findings in *Section 6.2.2.6*). Participants discussed feedback as a single concept because the differing forms all served a common purpose of communicating with the user about their current, past, or future performance. Therefore, they are combined into a unified strategy labelled as urupare (feedback).

System-driven interaction is a critical element of persuasive technologies, including gamified interventions. Fogg (2003) stated that the use of praise in in-app communication had a positive effect on user attitude toward the technology, and Oinas-Kukkonen and Harjumaa (2009) found that systems dialogue enhances performance by making the technology more persuasive for users. Meixner et al. (2020) argue that the use of feedback features in persuasive technologies satisfies an individual's desire for *competence*, a key determinant of motivation in *Self-Determination Theory* (Deci & Ryan, 1985), as comparing current performance against previous performance motivates an individual to improve.

This research found that technology-generated feedback in the form of individual performance tracking and self-monitoring supports accountability and incremental improvement; a finding consistent with previous research demonstrating that feedback supports personal goal-setting, self-monitoring, and programme adherence (Orji & Moffatt, 2018; Orji, Nacke, et al., 2017; Pinder et al., 2018). Orji et al. (2014) consider that self-monitoring and feedback are labels for the same concept.

It is interesting to note that Oyibo and Vassileva (2019) found *goal-setting* and *feedback* (presented as a single strategy) to be only marginally more effective in individualistic cultures than collectivistic cultures, and it ranked as the most persuasive strategy by both collectivist and individualist cultures. The current research does not explore goal-setting as a strategy, rather, goal-setting is considered a fundamental element of behaviour change interventions, particularly in the health domain (Chung et al., 2017), and has been associated with positive health behaviour change (Mamede et al., 2021). Therefore, the current research determines that goal setting is the design principle for implementing gamification in behaviour change technologies rather than a persuasive strategy. This is consistent with Oyibo and Vassileva (2019), who stated that "every minimally viable health application aimed at behavior change, for it to be effective, must have at least the functionality of goal-setting and self-monitoring, both of which we considered complimentary fundamental features" (p. 14).

One aspect of feedback identified in the current research is commentary on an individual's performance, such as, tracking and comparing one's own current performance against previous performance, is highly motivating. As in the Oyibo and Vassileva (2019) study, this research found the most highly ranked persuasive strategies by Māori are Mahi Tahi (cooperation), and urupare (feedback).

In this case, urupare also includes feedback in the forms of whakataruna (simulation) and marohi (suggestion). Marohi (suggestion) is an important aspect of feedback for Māori. This study found that system-generated suggestions for activities and goals simplifies decision making and therefore may lead to enhanced programme adherence. However, there is no extant literature supporting whether this finding is unique to Māori, as to date, no studies have explored this aspect of feedback from a cultural perspective. One aspect of in-app communication and feedback that has been previously explored, is the relationship between systems dialogue and tailoring an intervention to the needs of the individual. This is discussed in the following subsection.

7.3.5 ĀHUATANGA URUTAU (CUSTOMISATION)

Tailoring health behaviour change interventions toward the specific needs of the target audience rather than assuming a one-size-fits-all approach is critical (see Akker et al. (2014); Berger and Schrader (2016); Eysenbach et al. (2012); Hamari et al. (2018); Mamede et al. (2021); Orji et al. (2019) for examples). The current research takes a Māori-centric approach to design by integrating tikanga Māori (cultural protocols) principles to conceptualise, develop, and evaluate a gamified mobile health application that supports the healthy lifestyle aspirations of Māori. Te Morenga et al. (2018) explain that culturally-tailored behaviour change interventions may be more effective for Indigenous populations, and this principle has driven every decision in the current research project.

Aside from culturally-tailored interventions, there are two further aspects of customisation previously identified from persuasive technology literature: *Personalisation*, a form of system-tailoring that adapts the content and functionality based on an individual's characteristics; and, *customisation*, which allows a user to adapt a system's content and functionality based on their personal preferences (Orji et al., 2014). Findings presented in *Section 6.2.2.4* showed the significant difference between personalisation and customisation is the initiator of the tailoring. In the case of personalisation, the system is adapting to the individual; and in the case of customisation, the individual is controlling the adaptation.

The current study found that the *initiation* of the adaptation is not important, provided the application met the needs of users, which included: Māori-centric design; culturally appropriate language; personalised goal setting; personalised communications; and customisable elements such as creating a unique avatar, and control over public/private persona settings. These findings are not unique to this study. Previous Indigenous research has shown that culturally-tailored activity suggestions, well-being information, tikanga Māori (cultural protocols), and culturally appropriate motivational messages may lead to increased engagement and a sense of ownership experienced by target end users (Ni Mhurchu et al., 2019).

In the current research, participants considered adaptability of an avatar to be very important, as it was considered as a digital representation of self. This finding is consistent with previous research; Brüll et al. (2016) found that users had a preference for highly customisable avatars as a digital representation of self, and this led to increased improved attitude toward the application, and increased enjoyment.

This research found that customised suggestions for physical activities, meal-planning, and both individual and group goals are perceived to be motivational for users. As previously mentioned, goal-setting is a critical aspect of behaviour change interventions (Mamede et al., 2021). Customisation supports individualised goal-setting and can lead to improved programme adherence, particularly as the system suggests "the RIGHT thing at the RIGHT time in the RIGHT way" (Akker et al., 2014, p. 354).

There is a well-documented relationship between customisation and autonomy (Koivisto & Hamari, 2019), in that the sense of controlling the look of an avatar or choosing one's own goals or application features satisfies the sense of autonomy (Meixner et al., 2020). Ryan and Deci (1999) argue that humans are intrinsically motivated to seek and engage with activities that support the users' autonomy, competence, and relatedness. Autonomy is directly related to the concept of self-efficacy and sense of control (Helmefalk, 2019). Although the concept of autonomy is not included in the RAA, Brickell et al. (2006) suggest that the ability to predict *behavioural intention* could be moderated by autonomy. Furthermore, Jacob and Ouimet (2015) stated it is logical that autonomy is a prerequisite for *perceived behavioural control* as an individual without autonomy is naturally incapable of forming a behavioural intention.

This subsection discusses āhuatanga urutau (customisation) from two perspectives: the need for culturally-tailored health behaviour change interventions, and the need for user autonomy over goal setting and user-features. While there is literature to support an

argument for culturally-tailored intervention (see Te Morenga et al. (2018) and Ni Mhurchu et al. (2019) for Māori-centric interventions), there is no literature to discuss whether there is a cultural dimension to customisation preferences. This is a notion that may benefit from additional research.

This section has sought to answer the research question: *which persuasive strategies are effective in gamified physical activity and diet interventions for Māori?* To address this question, it is important to consider how the findings from phase one relate to the extant literature. As there are few studies that explore the effects of culture on persuasive strategy preference, the discussion relies heavily on a few studies, thus highlighting an opportunity to contribute to knowledge in this area. *Sections 7.1* and *7.2* demonstrate that the Māori social context is unique and aligns with collectivistic cultural perspectives. The current research asserts that the Māori social context is a significant determinant of persuasive strategy preference.

One study that interprets the effect of culture on persuasive strategy preferences is Oyibo and Vassileva (2019); although their strategies do not perfectly align with the strategies identified from Orji et al. (2014); and Oinas-Kukkonen and Harjumaa (2009) which were adopted in the current research, there are five strategies which do align. Table 7.1 presents the six persuasive strategies from the current research; five of the strategies are ranked from most persuasive to least persuasive according to Oyibo and Vassileva (2019). It is important to note, that these rankings are from the perspective of a collectivistic culture. The sixth strategy, āhuatanga urutau (customisation), was not studied in Oyibo and Vassileva (2019), and so it appears on this list as unranked.

Table 7.1

Persuasive strategy preferences for collectivist cultures

Strategy (ranked for collectivist cultures)	**Orientation**	**Cultural preference**
1. Urupare – Feedback	Personally-oriented	No perceived difference
2. Mahi Tahi – Cooperation	Socially-oriented	Collectivist
3. Momoho – Reward	Personally-oriented	Collectivist
4. Whakataetae – Competition	Socially-oriented	Individualist
5. Whakatauritenga – Comparison	Socially-oriented	No perceived difference
Āhuatanga urutau – Customisation (unranked)	Personally-oriented	Not stated

Adapted from Oyibo and Vassileva (2019); Orji et al. (2014); and Oinas-Kukkonen and Harjumaa (2009)

Oyibo and Vassileva (2019) stated that each strategy is either socially or personally oriented. Simply, socially-oriented strategies entail interaction with other users, and personally oriented strategies do not. People from collectivist cultures are more likely to be susceptible to *cooperation* than individualists, and collectivists rank *cooperation* higher than *competition* (Oyibo *&* Vassileva, 2019). Therefore, this study proposes that the ideal persuasive strategies for a gamified physical activity and diet intervention designed for Māori users will likely align with the findings of Oyibo and Vassileva (2019) in multiple ways. Firstly, urupare (feedback) will be an important design consideration, but that there is no cultural basis for stating that this preference is unique to Māori. However, as Māori are a collectivistic culture, it is likely that some Māori prefer socially-oriented strategies, and may be more susceptible to Mahi Tahi (cooperation) than Whakataetae (competition) and whakatauritenga (comparison).

The preferences as presented in Table 7.1 translate directly into design implications. Personally-oriented strategies such as feedback, reward, and customisation are critical elements of gamification design and should fundamentally underpin the design. It is currently not known if a cultural preference for āhuatanga urutau (customisation) exists. However, two forms of āhuatanga urutau were found to be important to Māori in the current research: Māori-centric design; and autonomy over goal setting and user-features of the application. Therefore, these are also fundamental design considerations.

Oyibo and Vassileva (2019) found that people from collectivist cultures perceive they will be more susceptible to cooperative strategies compared to competitive strategies. However, this study posits that the preference for Mahi Tahi over Whakataetae may be a result of the degree of social connection between users, as there is an argument that some Māori are competitive against people they are not socially connected to. The implications for design are that it is less clear, and therefore this preference will benefit from further research.

One aim of *Section 7.3: Persuasive Strategies* is to address RQ2 which asks: *which persuasive strategies are effective in gamified physical activity and diet interventions for Māori?* This section has discussed six persuasive strategies and determined which strategies may be perceived by Māori as most effective. However, it has not discussed how the game design elements identified from the literature and discussed in *Section 2.2.2: Gamification Design Elements* can be deployed to support these strategies. The next section discusses ideas and examples proposed by participants in co-design hui to operationalise persuasive strategies.

7.4 IMPLEMENTING GAME DESIGN ELEMENTS

As previously discussed, (see *Section 6.3.1: Theme Four: Game Design Elements*) game mechanic selection is contextual, suggesting that persuasive strategy is the primary decision an intervention designer needs to make, and that the appropriate game mechanic combinations are selected to support the strategy. Table 7.2 summarises these combinations. It is interesting to note that the findings in this section are not unexpected as it appears entirely logical that key game mechanics such as points, badges, challenges, and leaderboards would be commonly selected in the key socially-oriented strategies of cooperation and competition. These decisions are discussed in the following subsections.

This section shows how gamification can be operationalised for each of the four target behaviours previously presented in *Section 6.3.2*: *Theme Five: Matching Strategies with Mechanics*. Findings in this section address RQ3*: Which configurations of game design elements support specific persuasive strategies for Māori?* In the following subsections, each target behaviour is presented separately. Ideas for implementing all persuasive strategies and mechanics as selected by participants are also presented. It is important to note, that some of the operationalisation ideas presented in *Section 7.4.1: Implementing Game Design Elements*, were common for all target behaviours, and were not repeated subsequently.

Table 7.2

Game mechanic combinations to support persuasive strategies

Game Mechanic	Mahi Tahi Cooperation	Urupare Feedback	Whakataetae Competition	Whakataurite Comparison	Momoho Reward	Āhuatanga urutau Customisation
Kōeke – Levels	✓	✓	✓	✓		
Māka – Points	✓		✓			
Pakiwaitara – Narrative Context	✓	✓				✓
Papa tātai – Leaderboards	✓		✓	✓		
Tohu – Badges	✓	✓	✓		✓	
Wero – Challenges/Quests	✓	✓	✓	✓		
Whakatangata – Avatars		✓			✓	✓
Whakatauranga – Ratings		✓		✓		
Whakatutukitanga – Achievements	✓	✓				✓

7.4.1 TARGET BEHAVIOUR: INCREASE PHYSICAL ACTIVITY

There are multiple studies that demonstrate the efficacy of gamified fitness or health technologies for increased physical activity (Hamari & Koivisto, 2015b). Chen et al. (2014) found that social features of gamification during exercise, such as cooperation and competition, fostered increased physical activity compared with people who exercised alone. A behavioural goal such as consistently walking 10,000 steps per day could be converted to a quest within a health application by integrating various persuasive strategies and game design elements into the intervention's design.

Table 7.3 presents examples of how each of the specific persuasive strategies chosen in *Section 6.2.2: Theme Three: Persuasive Strategies*, can be gamified using the game design elements selected by participants as presented in *Section 6.3.1: Theme Four: Game Design Elements,* within the context of a very specific target behaviour. The examples used in this table represent the researcher's interpretation and aggregation of findings from across all hui. Table 7.3 shows only the mechanics associated with each strategy by the participants. For example, participants associated pakiwaitara (narrative context) with Mahi Tahi (cooperation) but not with Whakataetae (competition), and therefore, narrative context does not appear on this table as a mechanic for Whakataetae.

Table 7.3

Target behaviour: Increased physical activity

Strategy	Mechanic	Example: ***Walk 10,000 steps per day – Hīkoi 10k***
Mahi Tahi Cooperation	Pakiwaitara Narrative context	The app uses a kaiārahi (guide) to communicate with the user. Tēnā koe, e hoa! (Hello, friend!) On your *Hīkoi (walk) to Health*, you will face many challenges and celebrate many achievements. Our achievements are greater when we reach them with our friends and whānau.
	Wero Quests	*Hīkoi 10k:* This quest begins with a small task of asking a friend or whānau member to talk a short outdoor walk. Each day the goal is increasingly challenging, either adding more steps, or adding more whānau until each person is completing 10,000 steps.
	Whakatutukitanga Achievements	This goal can be achieved in stages, the successful completion of each stage will be marked with feedback and rewards.
	Māka Points	Points are earned for completing stages of the quest, experience points are gained for inviting whānau on the hīkoi. Whānau points are visible to other players.
	Tohu Badges	A unique Hīkoi *Tahi – Walk Together* badge is awarded to all members of the whānau group for successfully completing the *Hīkoi 10k* quest. Whānau badges are visible to all players.
	Papa tātai Leaderboards	Show the combined number of steps for the whānau on a leaderboard; compare these to the leading whānau group step-counts. Only whānau combined steps are visible to other players.

	Kōeke Levels	Accumulated whānau experience points contribute to a whānau level, each new level requires increasingly challenging quests, and higher points targets.
Whakataetae Competition	Wero Quests	*Hīkoi 10k in 10 Days:* this quest requires the individual user to increase their daily step count from baseline to 10,000 per day
	Whakatutukitanga Achievements	Achievements mark the successful completion of each stage of a quest and will be marked with feedback and or rewards
	Māka Points	Points are awarded to the individual user each time their daily step count is 10% higher than the previous day. Total XP are visible to other players
	Tohu Badges	A *Hīkoi 10k in 10 Days* special badge is awarded to the individual the first time they achieve the target behaviour; the badge also contains a lifetime achievement record of the total number of times the individual has achieved the goal. Badges are visible to other players.
	Kōeke Levels	Individual's experience points contribute to levels, which have increasingly challenging points target for each level. Levels are visible on the user's profile.
	Whakatangata Avatars	The individual's avatar can be upgraded or increasingly personalised after each level is attained. The avatar is visible to other players.
	Whakatauranga Ratings	Ratings represent a player valuation, which is linked to point's mechanics. Points can be awarded for daily task logging, and a five-day streak results in 5 stars. Stars are lost when players fail to log a daily task. Ratings stars are visible to all players on the user's profile.
Whakatauritenga Comparison	Kōeke Levels	Cooperation: combined whānau levels are visible to members of other whānau teams. Competition: Levels are visible on a user's profile, and other users can compare their own performance against that of any other user.
	Māka Points	Cooperation: Overall whānau points are visible and individuals can see how their own performance has contributed to a group point's total. Competition: Experience points are visible on a user's profile, and other users can compare their own performance against other users.
	Papa tātai Leaderboards	Cooperation: A scoreboard shows the whānau names and current combined XP scores of the leading teams, each user can see their whānau teams overall ranking. Competition: A scoreboard shows the avatar/names and current XP scores to the leading competitors; each user can see their own personalised overall ranking.
	Tohu Badges	Cooperation: Whānau badges are visible to all players; users within a whānau can see their progress towards achieving the next group badge Competition: Badges are visible to other players, and some badges will be highly sought after, and people will strive to achieve them
	Wero Quests	Cooperation: the status of the *Hīkoi 10k* quest is visible to all whānau members who have joined or been invited, and therefore, members will be encouraged to participate. Competition: an individual's progress in the *Hīkoi 10k in 10 Days* quest is ranked, and visible to other players, and therefore, individuals will be encouraged to strive for a higher ranking.
Urupare Feedback	Kōeke Levels	A progress bar for each level of the quest will provide information to players on their status, and the requirements to reach the next level.
	Pakiwaitara Narrative context	You are courageous and making great progress on your quest. You completed 5,500 steps yesterday. Ka pai tō mahi e hoa!!! Take 6,100

		steps today and you will be on your way to success. The app uses a kaiārahi (guide) to communicate with the user
	Tohu Badges	An achievement badge is earned following the successful completion of the quest. The requirements for achieving the badge are available for the user, and they are provided updated information as they progress toward earning the achievement.
	Wero Quests	Recommend certain actions for achieving quests. Give feedback on current and future performance.
	Whakatangata Avatars	The app uses a kaiārahi (guide) to communicate with the user. The kaiārahi appears as an avatar on screen to present feedback on how the user is tracking. In addition, the user's avatar can be adapted by the user following successfully completing quests.
	Whakatauranga Ratings	Users can receive ratings in the form of stars (gold, silver, and bronze) for effort toward achieving the goal. Each day the use meets the step count of the previous day, they receive a bronze star, 10% increase gives a silver star, and 25% increase gives a gold star. The stars are visible on a player's public profile.
	Whakatutukitanga Achievements	Completing the quest triggers rewards such as badges and avatar upgrades.
Momoho Reward	Tohu Badges	A unique badge is awarded for successfully completing the *hīkoi 10k* quest. If the quest was completed in teams, all contributing team members receive the badge.
	Whakatangata Avatars	A unique avatar upgrade is awarded for successfully completing the *hīkoi 10k* quest. If the quest was completed in teams, all contributing team members receive an upgradable item.
Āhuatanga urutau Customisation	Pakiwaitara Narrative context	The app uses a kaiārahi (guide) to invite users to begin quests and to make suggestions about personal goals the user might want to accomplish. Each user makes unique decisions about their personal goals, and the app suggests quests that can be undertaken individually or in teams.
	Whakatangata Avatars	Completing the quest triggers rewards such as badges and avatar upgrades. These avatar upgrades allow the user to customise their avatar.
	Whakatutukitanga Achievements	Goals can be personalised or suggested by the application, and therefore each user will have a unique journey and set of achieved goals or quests.

Health behaviour change intervention gamification decisions are different depending on the overarching persuasive strategy selected. For example, persuasive strategies such as Mahi Tahi (cooperation) and Whakataetae (competition) would use different mechanics, and therefore, the examples presented are unique to each strategy. On the other hand, whakatauritenga (comparison) appears to support both the Mahi Tahi and Whakataetae strategies. Whakatauritenga allows a group, or an individual to compare their performance against other groups or individuals, and as previously discussed, Bandura (1989), stated that when individuals observe other people being rewarded for carrying out specific behaviours, they are more likely to also perform the behaviour and meet the referents' perceived behavioural expectations. Table 7.3 also shows that whakatauritenga is split into both Mahi Tahi (cooperation) and Whakataetae (competition) strategies with

relevant mechanics and examples given for each perspective. This is because participants interpreted Mahi Tahi as cooperation occurring within the whānau, and Whakataetae as external to whānau.

The examples identified for whakatauritenga (comparison) are similar for all the target behaviours identified in the current research, and therefore in subsequent subsections, these examples will not be repeated. Table 7.3 also illustrates that personally oriented persuasive strategies such as feedback, customisation, and reward feature a degree of similarity in the proposed combinations of game-design elements. For example, as previously discussed, āhuatanga urutau (customisation) relates to Māori-centric design, as well as personalised user-experience, autonomy, and goal-setting.

Participants identified that game design elements such as narrative context, avatars, and achievements can be configured to meet customisation needs. Narrative context can relate to the background story as well as the way the application communicates with users including culturally appropriate language and messaging. From that perspective, narrative context is related to feedback as the application communicates with users and reports on their previous and current states and offers suggestions for future behaviours to help the user attain their personal goals.

When an individual meets a specific target goal, the application recognises this as an achievement, and achievements trigger feedback and rewards. This study finds that the configurable game-design elements for feedback, reward, and customisation strategies are common for multiple activity-based target behaviours, and therefore for the purposes of minimising repetition, the following subsections will only present unique ideas for the strategies: Mahi Tahi (cooperation) and Whakataetae (competition).

7.4.2 TARGET BEHAVIOUR: CLIMB A MOUNTAIN (FIGURATIVELY)

The target behaviour: *climb a mountain* describes the idea of having a significant challenge that could be broken into smaller sections to keep people motivated and engaged, is the basis of the mountain quest idea. The name of this quest is *Whāia te iti kahurangi*, which means: aspire to lofty goals. This target behaviour is an interpretation of an idea discussed in two hui and presented in *Section 6.3.2.2: Target Behaviour: Climb a Mountain (Figuratively).*

Table 7.4 shows examples of how the persuasive strategies Mahi Tahi (cooperation) and Whakataetae (competition) can be gamified using the game design elements selected by participants as presented in *Section 6.3.1: Theme Four: Game Design Elements,* within the

context of a step challenge of 100,000 steps. This example is explored from both the cooperative and competitive perspectives. In this subtheme, it can be assumed that the mechanics associated with the other persuasive strategies are like those presented in *Section 7.4.1,* and therefore, these will not be repeated here.

Table 7.4

Target behaviour: Climb a mountain (figuratively)

Strategy	Mechanic	Example: 100,000 steps target – ***Whāia te iti kahurangi***
Mahi Tahi Cooperation	Pakiwaitara Narrative context	The app uses a kaiārahi (guide) to communicate with the user. Tēnā koe, e hoa! Whāia te iti kahurangi is an extraordinary challenge, and one you should not undertake on your own. You will face many challenges and celebrate many achievements. Our achievements are greater when we reach them with our friends and whānau.
	Wero Quests	Whāia te iti kahurangi: This is a group quest for a team of climbers. Ask friends and whānau members to form a team, a minimum of 3 team members is required. The quest is broken into multiple stages, each team member needs to complete a stage before the next stage can begin. No climber is left behind. There is no time-limit for the quest.
	Whakatutukitanga Achievements	This team goal is achieved in stages, the successful completion of each stage will be marked with feedback, rewards, and bragging rights.
	Māka Points	Whānau points are earned for completing stages of the quest. Total whānau points are visible to other whānau teams.
	Tohu Badges	A unique badge is awarded to all members of the whānau for successfully completing Whāia te iti kahurangi. Whānau badges are visible to all players.
	Papa tātai Leaderboards	A leaderboard shows the current progress of individuals within a whānau group. An overall leaderboard shows the current rank of all teams.
	Kōeke Levels	Accumulated whānau experience points contribute to a whānau level, each new level requires increasingly higher points targets.
Whakataetae Competition	Wero Quests	Whāia te iti kahurangi: This is a time-limited race quest that opens to all users on the same date. The quest requires an individual to reach 100,000 steps in the shortest amount of time. The race is completed individually.
	Whakatutukitanga Achievements	Achievements mark the successful completion of each level of a quest and will be marked with feedback and/or rewards
	Māka Points	Points are awarded to the individual user for completing each stage of the quest. Total XP are visible to other players on a leaderboard
	Tohu Badges	A unique Whāia te iti kahurangi special winner's badge is awarded to the individual who completes the challenge first, second, and third. A badge is awarded for all individuals who complete the challenge. Badges are visible to other players.
	Kōeke Levels	Individual's experience points contribute to levels, which have increasingly challenging points target for each level. Levels are visible on a user's profile.
	Whakatangata Avatars	A unique Whāia te iti kahurangi avatar is created for the winner of the challenge. The avatar can be upgraded or increasingly personalised after each level is attained. The avatar is visible to other players.
	Whakatauranga Ratings	Ratings represent a player valuation, which is linked to point's mechanics.

7.4.3 TARGET BEHAVIOUR: SHARING PRODUCE LOCATIONS

As previously discussed in *Section 6.3.2.3*: *Target Behaviour: Sharing Produce Locations,* one way to mitigate the expense of fresh produce was to create an in-app function that allows users to share details about the location of free and/or low-cost fruit and vegetables in their geographical area and earn rewards for contributing to and validating the user-generated data. Table 7.5 offers suggestions for how the target behaviour of sharing produce locations could be met using the cooperative and competitive persuasive strategies. The mechanics associated with the other persuasive strategies are similar those presented in *Section 7.4.1* and therefore, will not be presented again. Huarākau me ngā huwhenua means "the fruit and vegetable challenge".

Table 7.5

Target behaviour: Sharing produce locations

Strategy	Mechanic	Example: ***Huarākau me ngā huwhenua***
Mahi Tahi **Cooperation**	Pakiwaitara Narrative context	The app uses a kaiārahi (guide) to communicate with the user: Tēnā koe, e hoa! Eating healthy begins with choosing fruits and vegetables. You can help your whānau today by sharing your knowledge of a bargain! Do you have any fruit and vegetables, growing at your wāhi noho (residence) to share?
	Wero Quests	*Huarākau me ngā huwhenua (the fruit and vegetable challenge):* This quest begins with a simple task of identifying an opportunity to share information with other whānau members about a fruit and vegetable bargain. Users might have extra produce available in their own garden, or they may choose to share a bargain price from a local retailer. Locations are visible to players in the user's immediate network. This quest can be completed multiple times.
	Whakatutukitanga Achievements	Users achieve the huarākau me ngā huwhenua quest when they share the location of free, or low-cost fruit and vegetables with members of their whānau group.
	Māka Points	Points are earned each time the user completes huarākau me ngā huwhenua. Bonus whānau points are added every time whānau members also complete the behaviour. Whānau points are visible to other players.
	Tohu Badges	A unique whānau badge is awarded to all members of the whānau group that complete the huarākau me ngā huwhenua quest. The badge is upgraded depending on the number of times the whānau completes the target behaviour. Whānau badges are visible to all players.
	Papa tātai Leaderboards	Show the combined number of huarākau me ngā huwhenua quest completions for the whānau on a leaderboard; compare these to the leading whānau groups. Only whānau combined shares are visible to other players.
	Kōeke Levels	Accumulated whānau points contribute to a whānau level, each new level requires increasingly higher points targets.
Whakataetae **Competition**	Wero Quests	*Huarākau me ngā huwhenua (the fruit and vegetable challenge):* This quest begins with a simple task of identifying an opportunity to share information with other users about a fruit and vegetable bargain in a retail location.
	Whakatutukitanga Achievements	Users achieve the huarākau me ngā huwhenua quest when they share the retail location of low-cost fruit and vegetables with members of the public
	Māka Points	Prices need to be validated by other users. The individual user earns points based on the frequency of sharing, and the accuracy of the information shared. A user's total XP is visible to other players.
	Tohu Badges	The huarākau me ngā huwhenua special badge is awarded to the individual the first time they achieve the target behaviour; the badge also contains a lifetime achievement record of the total number of times the individual has achieved the goal. Badges are visible to other players.
	Kōeke Levels	Individual's experience points contribute to levels, which have increasingly challenging points target for each level. Levels are visible on the user's profile.
	Whakatangata Avatars	The individual's avatar can be upgraded or increasingly personalised after each level is attained. The avatar is visible to other players.
	Whakatauranga Ratings	A user earns a rating based on the number of times they complete the target behaviour. Low prices need to be validated by other users, and the individual user earns a reputation rating based on the frequency of sharing, and the accuracy of the information shared. Ratings are represented by stars in gold, silver and bronze.

7.4.4 TARGET BEHAVIOUR: CHOOSING FRUIT AND VEGETABLES

The quest idea for this subtheme is to encourage people to make healthier food choices by increasing their daily intake of fruit and vegetables. It is based off the ongoing 5+ *a day* campaign, which encourages people to consume five or more serves of fruit and vegetables every day. Table 7.6 shows examples of how the persuasive strategies Mahi Tahi (cooperation) and Whakataetae (competition) can be gamified using the game design elements selected by participants as presented in *Section 6.3.1: Theme Four: Game Design Elements,* within the context of *Kia rima ake ia rā (the 5+ a day challenge)*. This example is explored from both the cooperative and competitive perspectives.

The findings in this section address RQ3: Which configurations of game design elements support specific persuasive strategies for Māori? This subsection has discussed how individual game design elements can be combined to support each of the six persuasive strategies discussed in *Section 7.3: Persuasive Strategies*. Four target behaviours were identified from the co-design hui data analysis, and these were developed into wero (quest) ideas. Each quest was then considered from the basis of how separate persuasive strategies might drive decisions for game design element implementation. However, it became apparent that implementation ideas were only unique for Whakataetae and Mahi Tahi, and that the operationalisation of social comparison, customisation, reward, and feedback, were common for each of the four quests.

Table 7.6

Target behaviour: Choosing fruit and vegetables

Strategy	Mechanic	Example *Kia rima ake ia rā (the 5+ a day challenge)*
Mahi Tahi Cooperation	Pakiwaitara Narrative context	The app uses a kaiārahi (guide) to communicate with the user: Tēnā koe, e hoa! fruit and vegetables are an important part of a healthy diet, and may help reduce the chance of us getting sick in the future. Let's make a healthier choice today.
	Wero Quests	*Kia rima ake ia ra te wero (the 5+ a day challenge):* This quest begins with asking a whānau member to join you on a quest to eat five servings of fruits and vegetables every day for seven days. It also rewards teams for achieving longer streaks. Teams are invited to add more whānau members to the challenge.
	Whakatutukitanga Achievements	Users achieve the *kia rima ake ia ra te wero* challenge when two or more members of the whānau group log 5+ for 7 days.
	Māka Points	Points are earned each time the whānau group completes the *kia rima ake ia ra te wero* behaviour. Whānau points are visible to other players.
	Tohu Badges	A unique bronze badge is awarded to all team members who complete the quest. The badge can be upgraded to silver and gold when teams complete the quest multiple times. Silver = 10 times, Gold = 50 times.
	Papa tātai Leaderboards	The leaderboard for this quest shows which teams have the longest streak of successfully completing the *kia rima ake ia ra te wero* challenge.
	Kōeke Levels	Accumulated whānau points contribute to a whānau level, each new level requires increasingly higher points targets.
Whakataetae Competition	Wero Quests	*Kia rima ake ia ra te wero (the 5+ a day challenge):* This is a 28-day quest that rewards users for choosing more than five servings of fruit and vegetables every day. Users log fruit and vegetables into their food diary. The quest runs for 28 days to encourage users to develop a healthy food habit.
	Whakatutukitanga Achievements	The quest is completed after 28 days of logging five servings of fruit and vegetables every day.
	Māka Points	Points are awarded for every serving of fruit and vegetables logged, up to a maximum of 8 servings each day, bonus points are awarded for daily log streaks longer than 7 days
	Tohu Badges	Users earn a unique bronze completion badge, which is upgraded every time the 7-day streak is achieved. Silver = 10 times, Gold = 50 times. A unique *kia rima ake ia ra te wero* challenger badge is awarded to the individual who earns the highest number of points during the challenge. Badges are visible on a user's profile.
	Kōeke Levels	Individual's experience points contribute to levels, which have increasingly challenging points target for each level. Levels are visible on the user's profile.
	Whakatangata Avatars	The individual's avatar can be upgraded or increasingly personalised after each level is attained. The avatar is visible to other players.
	Whakatauranga Ratings	Ratings represent a player valuation, which is linked to point's mechanics. Points can be awarded for daily task logging, and a seven-day streak results in 5 stars. Stars are lost when players fail to log a daily task. Ratings stars are visible to all players on the user's profile.

As previously discussed in *Chapter Five: Phase One Research Design,* an outcome of Phase One of the current research is a non-interactive prototype of a gamified health behaviour change application. Development of the application itself will be discussed in the next section.

7.5 ARTEFACT DESIGN

The primary outcome of Phase One of the current research is a non-interactive prototype of a gamified health behaviour change application which is aimed specifically at supporting positive health behaviour change for Māori. *Hīkoi to Health* (walk to health) is the working title of this application. The name suggests that good health is a journey, and a journey begins by taking a single step. This subsection presents the steps taken by the researcher to develop *Hīkoi to Health.*

The nominal process followed is described in *Section 5.1*: *Kaupapa Māori and Design Science Research*, and this subsection explains the activities undertaken in *Activity 3: Design and develop the artefact*, and *Activity 4: Demonstrate the artefact*. Although the current research cannot be categorised as following a strict design science research (DSR) design, the process followed for designing the prototype was heavily guided by DSR literature.

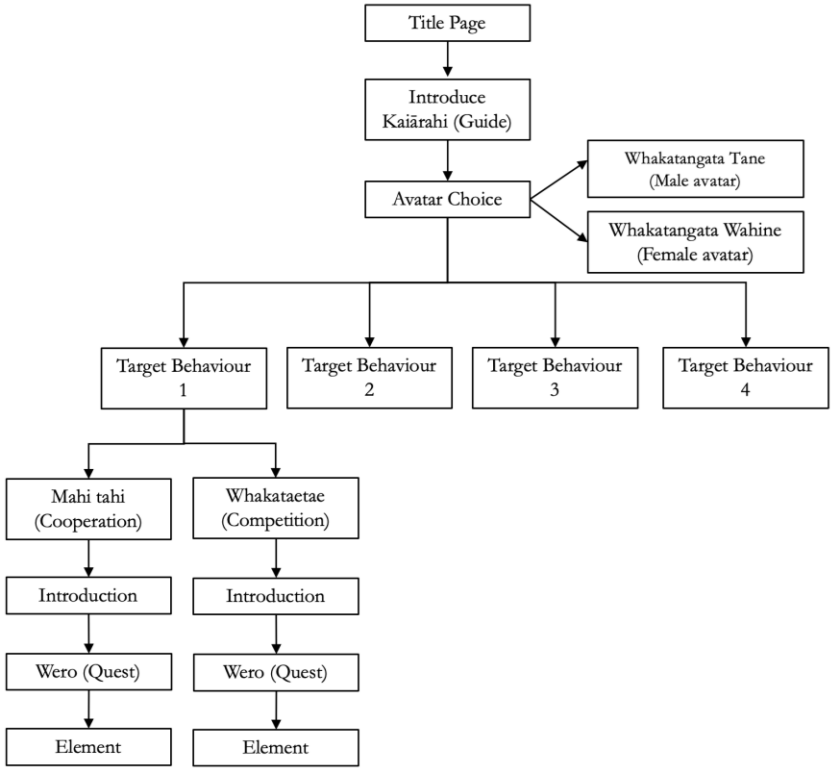
7.5.1 ACTIVITY 3: DESIGN AND DEVELOP THE ARTEFACT

Much of the pre-design planning is documented in *Section 7.4: Implementing Game Design Elements*. The idea was to develop storyboards for an application that conveyed how each of the target behaviours could be developed as a wero (quest). The researcher has previous experience as a website designer, and utilised these skills to interpret and visualise te wero (the challenges). The first step was to create a simple architecture plan showing the user journey for each of the original target behaviours presented and discussed in *Section 7.4*. An example plan is illustrated in Figure 7.2*,* it begins with a title page, this would be the opening page of a smartphone application. On the second page, first-time users are presented with a kaiārahi (guide), the role of the kaiārahi is to guide users through the application and to explain to users what they should do on each screen. The third page presents users with an option to choose their avatar, for the purposes of this storyboard only two options are given, however in a working prototype, the user would have multiple options.

Figure 7.2 shows each target behaviour is developed into a Mahi Tahi (cooperation) quest idea, and a Whakataetae (competition) quest idea. Each wero begins with a kaiārahi introduction screen and the quest itself is presented and explained on the next screen and the user is invited to continue with the quest. Finally, a completion screen is presented which would contain a game-design element such as points, badges, leaderboards or a reward chosen from the appropriate tables presented in sections *7.4.1* to *7.4.4*.

Figure 7.2

Simple application architecture plan



Prior to the target behaviours and quests, the architecture plan illustrates several onboarding activities. The first of these is a storyboard introducing the kaiārahi (guide) for the application, and another storyboard encouraging users to choose an avatar to digitally represent themselves. Although onboarding activities have not been previously discussed as persuasive strategies or game design elements, they were included in order to make the prototype more closely resemble an actual smartphone application.

Following the development of an architecture plan for each target behaviour, I created a series of illustration ideas that would simply convey the key idea of each quest. The list of illustration ideas is presented on Table 7.7

Table 7.7

Prototype illustration plan

Target behaviour	Quest idea	Illustration idea
Get Started	Onboarding activity	An illustration of a Kaiārahi. A wise, mature Māori woman
Choose an Avatar	Onboarding activity	Simple choices of a man or a woman avatar
Walk 10,000 steps	**Hīkoi Tahi – Walk Together** Take a short walk outdoors with a friend	Two people walking together. A young woman and her grandfather walking outdoors
	Step in the Right Direction An individual target to reach 10,000 steps each day	An individual is walking by themselves to meet their daily step target
Walk 100,000 steps	**Whāia te iti Kahurangi – Mountain of a challenge** A team quest where each member needs to reach 100,000 steps	Multiple people climbing a mountain, helping each other
	Whāia te iti Kahurangi – Mountain of a challenge An individual race to reach 100,000 steps in the shortest time possible	An individual in hiking gear climbing a steep slope alone
Choosing fruit and vegetables	**Huarākau me ngā huawhenua – A fruit and vegetable challenge** Sharing fruit and vegetables from your own garden with friends and whānau	A woman picking vegetables from her own garden
	Huarākau me ngā huawhenua – A fruit and vegetable challenge Sharing information with the community about the location where cheap fruit and vegetables can be bought	A woman with a shopping bag containing fruit and vegetables
Eating more fruit and vegetables	**Kia rima ake is rā** **5+ a day Challenge** A whānau goal of eating 5+ fruit and vegetables every day for 7 days	Two whānau members eating fruit together
	Kia rima ake is rā **5+ a day Challenge** A personal goal of logging 5+ fruits and vegetables every day for 7 days in a food diary	An individual eating a bowl of salad

The next activity in the design and development stage was to begin the illustrations. These were drawn by the researcher using Adobe Illustrator, and when completed were imported into Adobe InDesign onto a template that simulates the display screen of a smartphone. The background of the template uses a colour that represents harakeke, a New Zealand flax that is traditionally used by Māori for many purposes including weaving. Following the completion of the illustrations, a series of storyboards were drafted for initial review. The text was written in English and translated by the researcher. Once the draft storyboards were completed, a few participants from the original co-design hui that are fluent in Te Reo Māori (Māori language) were invited to provide feedback on text and design.

Figures 7.3 and 7.4 show different versions of the kaiārahi storyboard. Initially, the idea was to use an illustration of Kaiārahi Hera, drawn from a photograph of the researcher's tipuna (ancestor). However, one of the Te Reo advisors suggested that some Māori consider an individual's image is sacred and therefore might find this culturally offensive. Another advisor stated that not all older Māori looked like this, and people might not identify with her. Taking this feedback into consideration, the image of Kaiārahi Hera was replaced by Kaiārahi Pīpī, a Pīwakawaka (fantail – a native bird).

Figure 7.3

Kaiārahi Hera

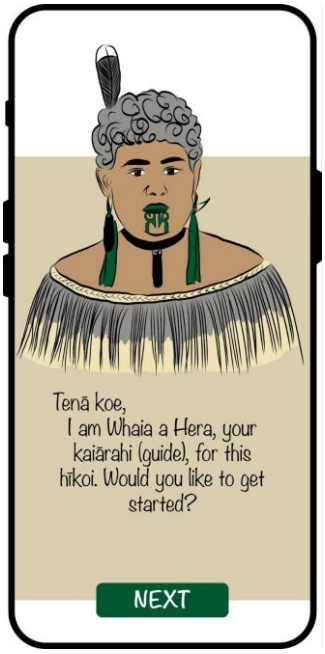
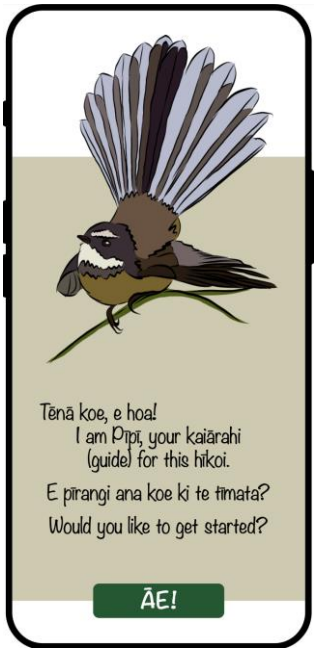


Figure 7.4

Kaiārahi Pīpī



All Illustrations were drawn by the author

The pīwakawaka (fantail) is chosen for several reasons. Firstly, they are well known in Aotearoa for their behaviour of flitting slightly ahead of humans as they walk through the trees disturbing insects; in a sense, pīwakawaka guide humans on a hīkoi (walk). The name Pīpī is both a reflection of pīwakawaka, and the sound of the fantail call. In addition to feedback on the kaiārahi, one of the participants agreed to give additional support for the text and we met to ensure the language was culturally respectful, that the use of Te Reo Māori (Māori language) was correct, and to ensure that it conveyed the intended meaning. Once the feedback was collated and changes made, the completed prototype was demonstrated to more stakeholders. The completed prototype designs are presented in Figures 7.5 to 7.13.

Figure 7.5 *Onboarding storyboards*

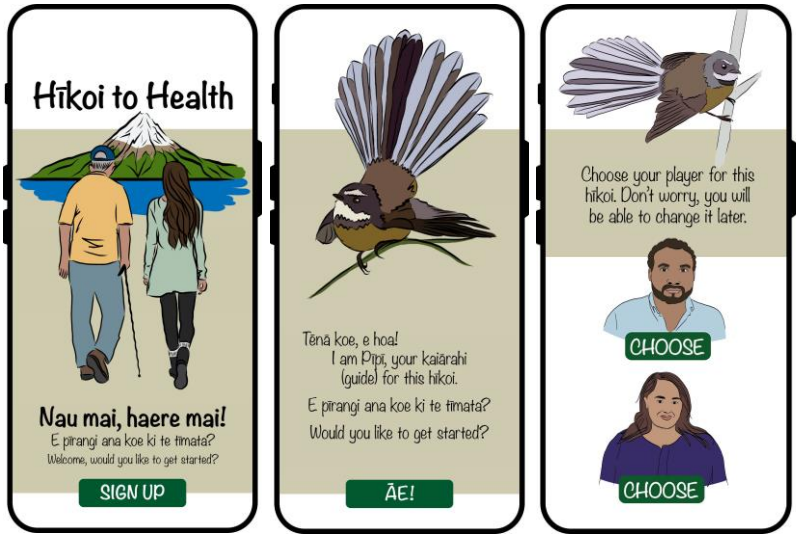


Figure 7.6 *Increase physical activity (cooperative quest) storyboards*

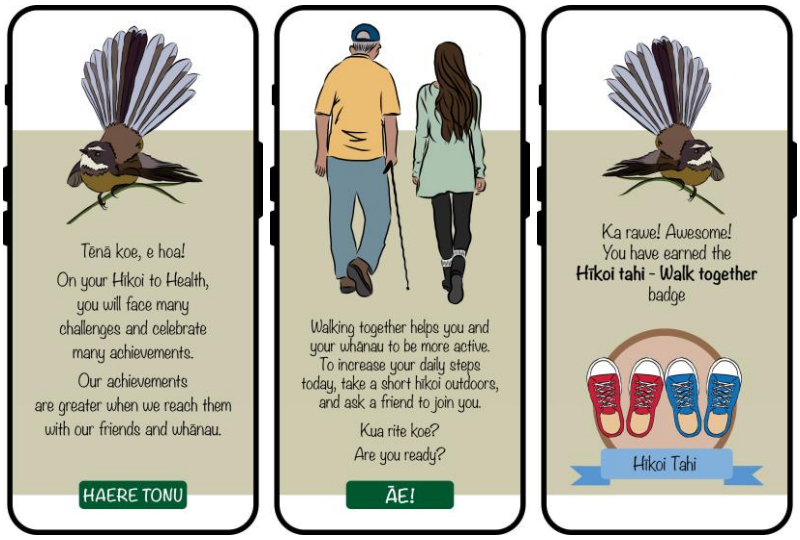


Figure 7.7 *Increase physical activity (competitive quest) storyboards*

Figure 7.8 *Climb a mountain (cooperative quest) storyboards*

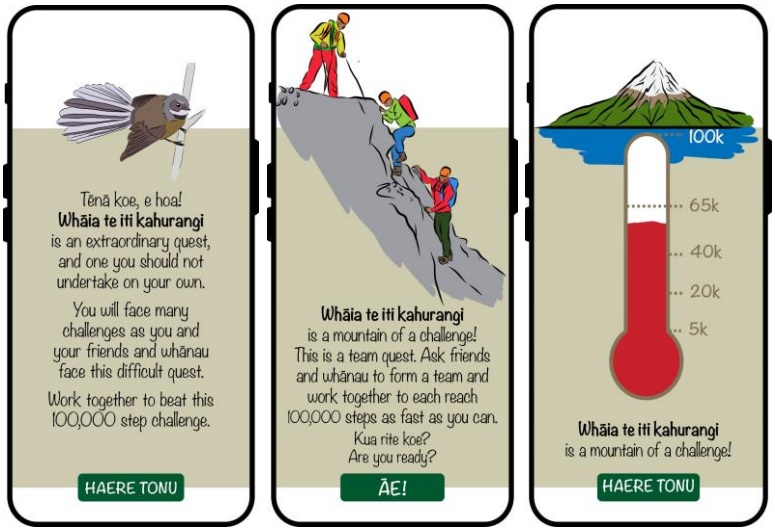


Figure 7.9 *Climb a mountain (competitive quest) storyboards*

Figure 7.10 *Sharing produce locations (cooperative quest) storyboards*

Figure 7.11 *Sharing produce locations (competitive quest) storyboards*

Figure 7.12 *Choosing fruit and vegetables (cooperative quest) storyboards*

Figure 7.13 *Choosing fruit and vegetables (competitive quest) storyboards*

The design decisions behind each storyboard are the researcher's interpretation of the data presented, based on her direct involvement in each of the hui. These were previously discussed in *Sections 7.4.1 to 7.4.4*, where each previously identified target behaviour was developed into a wero (quest) idea. Each wero (quest) is considered from the perspective of both a cooperative and competitive strategy. The next subsection will discuss the iterative process followed for demonstrating the prototype to previous participants and research stakeholders.

7.5.2 ACTIVITY 4: DEMONSTRATE THE ARTEFACT

Once the prototype designs were completed and the feedback was incorporated, the storyboards were disseminated to a wider audience for feedback. Nine participants from the co-design hui had agreed to a follow-up contact, and were sent an electronic copy of the storyboards. Additionally, digital files were sent to the Māori advisors for this study, and to Māori people personally known to the researcher who had agreed to provide feedback. In total, fifteen people were invited to offer feedback on the storyboards.

Participants were specifically asked to provide confirmation that their ideas were represented as they intended. The feedback from this group resulted in some minor changes to the designs, however these were not significant. The feedback from previous participants was particularly valuable, as multiple participants commented that they were excited to see their ideas, and they indicated that they were proud of the ideas they had.

This section has outlined the activities undertaken in the prototype design, development, and demonstration stages. It has shown that the process was iterative, and

participants were given opportunities to consider the storyboards, identify their ideas, and offer feedback on the designs.

7.6 CHAPTER SUMMARY

This chapter has discussed the findings from *Chapter Six* in the context of extant literature, and through the lens of the Reasoned Action Approach (RAA) theoretical framework. Understanding the Māori social context is critical for designing a health behaviour change intervention. *Sections 7.1 and 7.2* allow us to answer RQ1. Importantly, *Section 7.1: Understanding the Māori Context* shows that social values such as Mahi Tahi (cooperation), manākitanga (caring for others), and ko tau rourou (generosity) are inherent in Māori society, and that these social values mediate normative beliefs. This section showed that some Māori self-identify as a collectivistic culture, and as such, normative beliefs affect an individual's beliefs about the perceived expectations of referents and their impact on motivation to comply with health behaviour change. *Section 7.1* showed that the Māori social context is unique as whānau have a strong influence on an individual's behaviour and suggests that Western gamification ideas may be ineffective in practice.

Section 7.2: Underlying Beliefs discussed the notion that fundamentally, participants believed that health behaviour change technologies such as fitness applications are beneficial to users and useful for supporting users to achieve their goals. Furthermore, technology users have beliefs relating to specific application features such as tracking, and personalisation. This section also discussed that behavioural and control beliefs have a positive impact on attitude and behavioural intentions particularly in health-related applications. Overall, users perceive technologies are accessible to them, and the section discussed that users also perceive they could control any factors that may facilitate or inhibit their adoption of a health-related application. This section highlighted that although device ownership and data connectivity may be a lower for Māori than non-Māori (Digital.govt.nz, 2019), the experience of participants in the current research also showed that connectivity was available to many. Finally, this section discussed the relationship between increased control beliefs led to increased motivation, and that motivation is associated with behavioural intentions.

Section 7.3: Persuasive Strategies specifically addresses RQ2, it related the findings from *Chapter Six* to extant persuasive technology literature by exploring the few studies that explore the cultural component of strategy preference. This section suggested that the persuasive strategy preferences identified in *Chapter Six* are somewhat similar to the

findings of Oyibo and Vassileva (2019). It suggests that urupare (feedback) and Mahi Tahi (cooperation) are perceived by Māori as the most effective strategies, followed by momoho (reward), Whakataetae (competition), and whakatauritenga (comparison). Previous studies have not studied the effect of culture on preference for āhuatanga urutau (customisation). Additionally, *Section 7.3* explains how this research contributes to Indigenous gamification literature in the health domain.

Implementing game design elements is discussed in *Section 7.4* to address RQ3: *Which configurations of game design elements support specific persuasive strategies for Māori?* This section presents findings and discussion about specific elemental configurations. The section begins by identifying key target behaviours that participants perceived would be beneficial to support healthy lifestyle aspirations of Māori and reframed these as wero (quest) ideas. Ideas for combinations of game design elements to support each previously identified persuasive strategy were presented. However, the implementation ideas were common across each of the four quests for the operationalisation of social comparison, customisation, reward, and feedback. Therefore, following the first target behaviour, only Mahi Tahi and Whakataetae were presented.

Finally, *Section 7.5: Artefact Design* records activities undertaken to design and develop a non-interactive prototype of a gamified health behaviour change application which is aimed specifically at supporting positive health behaviour change for Māori. It follows steps outlined in Peffers et al. (2007). This section describes the iterative design process, and explains how stakeholders including Māori advisors, participants and other stakeholders were invited to provide feedback on the designs on multiple occasions. It discusses dome of the feedback challenges and how the feedback was incorporated into the final design to ensure cultural sensitivity and ensure that stakeholders considered the prototype reflected the co-design process.

This research project adapted the DSR process as outlined in *Section 5.1: Kaupapa Māori and Design Science Research*; a series of six research activities was previously outlined, and *Activity 3: Design and develop the artefact*, and *Activity 4: Demonstrate the artefact* were documented in this chapter. The next stage of the DSR process is *Activity 5: Evaluation,* the purpose of which is to compare the objectives of the solution as identified in *Activity 2* and compare these with the outcomes of the demonstration. *Activity 5* will demonstrate the prototype to the wider Māori population and evaluate the results against theoretical constructs to determine its efficacy. This research determines that a survey instrument is the appropriate vehicle to assess the prototype against constructs from gamification,

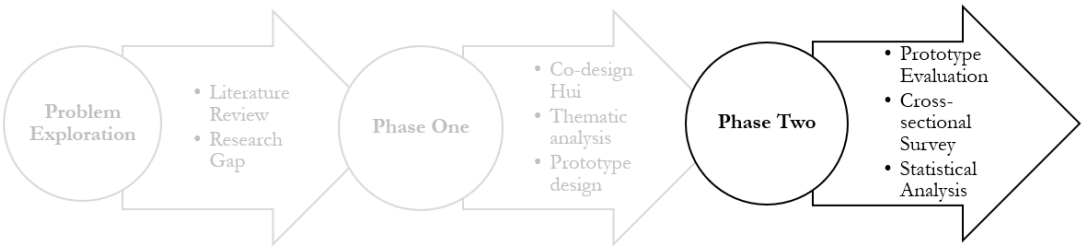
motivation, and health behaviour change theories. Justification for these decisions, results, and further discussion will be presented in *Phase Two: Evaluating the prototype*

CHAPTER EIGHT:
PHASE TWO RESEARCH DESIGN

This chapter explains the research design adopted in Phase Two. As illustrated in Figure 8.1, it builds off the findings and discussions previously presented to identify the framework that will be used to evaluate the effectiveness of the *Hīkoi to Health* prototype developed in Phase One. Phase Two will demonstrate the prototype to a broader Māori population and determine how well the prototype meets the objectives of a solutions previously discussed in *Chapter Five*. This chapter discusses the methodology chosen, the measures, scales and items developed for this phase. It describes the sample population, and the process for recruiting participants. Data collection and analysis decisions are explained before discussing ethical considerations.

Figure 8.1

Overview of the research design: Phase Two



As previously discussed, the current research follows a six-step design science research (DSR) process (see *Section 5.1.1: The Design Science Research Process*). Activity 2 of the DSR process was to identify the design objectives of a solution, in this case, these objectives are threefold: to ensure the design includes the most effective persuasive strategies for Māori; to design an application that employs game design elements; and, to ensure the design is culturally appropriate and meets the needs of the target population. The main purpose of this phase of the current research is to evaluate how effectively the *Hīkoi to Health* prototype addresses these objectives. *Evaluation* is Activity 5 in the DSR process. Fundamentally, Phase Two will evaluate whether Māori participants consider the prototype to be a Māori-centric and effective design. Findings from Phase One suggest that Mahi Tahi (cooperation) and Whakataetae (competition) were identified by participants as the most desirable socially-oriented persuasive strategies for Māori, and of the two, Mahi Tahi is perceived as more effective than Whakataetae. Phase Two will

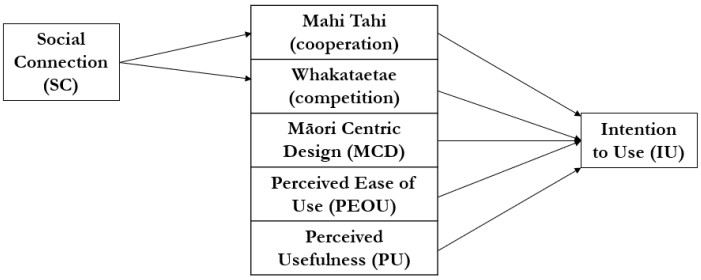
evaluate whether a broader Māori sample confirm these findings when considering the specific prototype.

An interesting finding from Phase One was the notion that an individual's social connection to other application users may affect their preference for Mahi Tahi or Whakataetae. Therefore, Phase Two also evaluates whether Social Connection is a factor in persuasive strategy preference. Phase One has partially answered *RQ1: What are the key contextual elements that shape Māori engagement in health behaviour change?* Phase One discussed how an individual's beliefs directly impact behavioural intentions. It discussed how behavioural beliefs underpin the individual's perceptions of a behaviour-change technology, which in turn have an impact on the individual's attitude toward the technology. However, Phase One did not fully explore whether participants perceived the technology would be useful to them, and nor did it fully explore their beliefs about their perceived ability to use the technology, both factors that Davis (1989) identified were antecedents of intentions for technology adoption.

The effectiveness of the *Hīkoi to Health* prototype can be evaluated by determining whether Māori perceive that the prototype would be useful, and whether they believe they would find the technology easy to use. These variables align with constructs from Davis (1989): *Perceived Usefulness* (PU) and *Perceived Ease of Use* (PEOU). Davis (1989) stated that PU and PEOU may predict a user's *actual* use of a technology. The current research postulates that the independent variables predict *Intention to Use* (IU). These independent variables are *Mahi Tahi* (cooperation); *Whakataetae* (competition); *Social Connection* (SC); *Māori-Centric Design* (MCD); *Perceived Usefulness* (PU) and *Perceived Ease-of-Use* (PEOU). Each construct was identified from the extant literature, findings, and discussions in previous chapters, and the scales and items used in the survey were either adapted from previous research or developed for this research. The relationships between constructs are illustrated in Figure 8.2, and this model will be used to evaluate the *Hīkoi to Health* prototype. This model represents only a portion of the *Reasoned Action Approach (Technology)* theoretical framework for the current research.

Figure 8.2

Relationship between independent variables and dependant variables



The Mahi Tahi (cooperation) and Whakataetae (competition) constructs measure the degree to which individuals prefer each persuasive strategy, and the degree to which this preference affects Intention to Use (IU). The current research hypothesises that in a Māori population, the preference for Mahi Tahi (cooperation) will be stronger than Whakataetae (competition). Social Connection (SC) is the degree to which an individual prefers to include other whānau members in their hīkoi to health. This study hypothesises that SC has a direct impact on Mahi Tahi and Whakataetae, and an indirect effect on IU. The current research also hypothesises that PEOU, PU MCD will have a direct impact IU. Previous studies have shown that PU and PEOU have a positive impact on behavioural intention (Davis, 1989), therefore the current research is expected to replicate that finding.

8.1 PHASE TWO RESEARCH DESIGN

This entire research project is grounded in Kaupapa Māori methodology and the principles of Kaupapa Māori have strongly influenced the design of this phase. The design is culturally respectful, and it upholds the mana (prestige, authority, spiritual power) of participants (Cram et al., 2021) in several ways: it uses Te Reo Māori (Smith, 2021) within the survey and prototype, but does not assume all participants are fluent; and, it asks questions designed to make a positive contribution to Māori health outcomes. The survey design addresses knowledge gaps about Māori health aspirations (G. H. Smith, 2012), and attempts to empower Māori (Cram et al., 2021) to support positive health behaviour change. The principles of tino rangatiratanga (self-determination) are upheld and a potential solution that was designed for Māori, by Māori (Smith, 2003), is evaluated and determined as fit-for-purpose by Māori.

The research design for this phase is a cross-sectional survey that captures Māori respondents' perceptions about the prototype. Cross-sectional studies are valuable for collecting data about how a population views a phenomena at a single point in time (Connelly, 2016), and have been used previously in health-technology studies. Examples

include: Chilukuri et al. (2015), who evaluated the differences in technology use between racial and ethnic groups of low-income pregnant and postpartum women; Narváez et al. (2016), who evaluated an mHealth application prototype designed to prevent Burnout Syndrome in the workplace; and Dobson et al. (2019) who used a cross-sectional survey to evaluate the needs and preferences of users of a pulmonary rehabilitation mHealth application in New Zealand. Cross-sectional survey design has previously been used in health gamification studies by researchers such as Allam et al. (2015); Hamari et al. (2018); Lienert and Patel (2020); and Meixner et al. (2020). These studies were previously discussed in *Chapter Two* and illustrate that cross-sectional studies are relevant for testing individual's perceptions across a broad range of topics including health gamification, technology usage, mobile health applications, and application prototype designs.

8.2 ETHICAL CONSIDERATIONS

This study has ethical approval from the *Human Research Ethics Committee (Health)* at the University of Waikato (HREC(Health)2021#80). The application that outlined how this survey fits within a wider study. As the whole study is undertaken within the context of Māori health, the research application was considered by the HREC (Health) committee. The researcher included her whakapapa information in the application to demonstrate that she is a member of the Māori community, and carefully explained how the study would exercise social and cultural sensitivity. To ensure anonymity of respondents, data that might identify an individual was not collected. Ethics statements and participant information sheets are appended to this research (see *Appendix I – Ethics Statements*), and respondents were given multiple opportunities to withdraw from the survey.

8.3 PARTICIPANT SAMPLING

This subsection discusses the processes followed for recruiting respondents and outlines the sampling techniques employed. It explains how the minimum sample size was calculated and describes why a non-probability sampling technique is appropriate.

The minimum number of survey completions needed to have sufficient power to detect a medium effect for a linear regression equation was 92 responses. This calculation was based on power =.80, α = .05 and five predictors. However, the minimum sample size for factor analysis is important, and multiple researchers generally agree this should be at least 100 respondents (Gorsuch, 1990; Kline, 1994). Furthermore, other researchers recommend calculating a participant-to-variables ratio for testing involving factor analysis,

and the recommended ratio varies between researchers: Cattell (1978) recommended a ratio between 3 and 6 times the number of variables; Everitt (1975) suggest a ratio of at least 10:1; and Hair et al. (2010) argues for a ratio of 20:1. Given these variances in recommendations, between 3 and 20 participants is required for each variable and there are 7 variables in the current research project. Therefore, the calculation suggests a sample size between 100 and 140 is required.

8.3.1 RECRUITMENT

To recruit participants for Phase One of this research project a website and a Facebook page called *Māori Health Research* were created. The website contains information about the purpose of the study, ethics information, details of co-design hui, and my profile and whakapapa. The Facebook page was used for recruitment posts which directed visitors to the website for more information. In the time between the co-design hui and Phase Two, the Facebook page gained over 600 followers. A series of posts inviting *Māori Health Research* followers to complete the survey were created.

In addition, members of another Facebook group were invited to participate. Approximately three years prior to Phase Two, I joined a Facebook group called Te Reo *Māori*, which had over 13,000 members in 2021. I sent a private message to the administrator of that group giving her whakapapa, explaining the purpose of the research, and asking permission to invite other group members to participate. This permission was granted.

Initially the recruitment process was extremely challenging, and the responses were very slow. In the first week approximately 25 responses were provided. Previous life experience has taught me that, by nature, people are willing to help each other if asked. Therefore, I personalised my approach to recruitment; I rewrote the recruitment posts to explain that I had been working on this research project for almost five years, and that I needed their help to complete the study. I explained that the research was very important for Māori health outcomes and invited Māori people to participate. I also shared these posts on my personal Facebook account publicly inviting my own friends and whānau to share the posts with their networks. Copies of the Facebook posts are included in *Appendix J – Facebook Posts*. The Facebook posts asking for help were shared by 45 people and multiple people tagged their friends and whānau to suggest they do the survey.

8.3.2 NON-PROBABILITY SAMPLE

In total, 377 respondents completed the survey over a two-week period. The survey was closed when there had been no new responses in a week. The survey used a combination of non-probability sampling techniques: convenience and snowballing. These techniques for recruitment have advantages as they allow the researcher to easily access participants, and to leverage social networks. This is valuable in research where no accessible list of potential respondents exists. Social sharing also allowed for quicker sampling as respondents reacted to their referents swiftly. However, it is acknowledged that this technique has limitations; the technique may have introduced potential sampling bias, and results may not be generalisable to the whole population. Sampling bias occurs due to the reasons that some people choose to complete a survey, and other people do not. In this instance, the Te Reo *Māori* Facebook group members all have a common characteristic that they are interested in reviving the Māori language. Therefore, the sample may contain an over-representation of Māori with strong views on Māori language. However, this is not seen as a negative attribute as the *Hīkoi to Health* prototype was being evaluated for its perceived Māori-centric design.

8.4 MEASURES

The first step in developing the measures for a survey was to clearly identify and define the constructs to ensure that each scale item is measuring factors that align with the research aims. The current research posits there are two critical factors relevant for evaluating the effectiveness of health behaviour change technology prototypes: *Do respondents believe they would use the technology?* And, *do respondents perceive the technology would be useful?* The current research has identified five constructs that can explain *Intention to Use* (IU) and *Perceived Usefulness* (PU): Mahi Tahi (cooperation); Whakataetae (competition); Social Connection (SC); Māori-Centric Design (MCD); and Perceived Ease-of-Use (PEOU). Each construct was identified and defined from the extant literature, and discussions in previous chapters.

Each construct was measured using a scale comprising 4 measurement items, and each item is a simple statement to determine how strongly individuals agree or disagree with the constructed statements. All scale items were measured using a Likert scale from strongly disagree (1) to strongly agree (5). The following subsections explain the measures used in the survey.

8.4.1 MAHI TAHI (COOPERATION)

Measure 1: Is there a preference for Mahi Tahi (cooperative) persuasive strategies? The aim of this scale was to measure the preference for Mahi Tahi (cooperation) strategies. The definition for Mahi Tahi was adapted from Orji et al. (2014), "*Cooperation* requires users to cooperate (work together) to achieve a shared objective and rewards them for achieving their goals collectively" (p. 457). The Mahi Tahi scale items were developed for the current research:

MTa	I would prefer to take an outdoor walk with a friend rather than by myself.
MTb	I would try harder to be more active if I was helping my whānau to be more active
MTc	Seeing our group's combined performance would keep me motivated
MTd	I prefer physical activities that include other people

8.4.2 WHAKATAETAE (COMPETITION)

Measure 2: Is there a preference for Whakataetae (competitive) persuasive strategies? Whakataetae (competition) was adapted from Orji, Mandryk, et al. (2017), who stated that "*Competition* strategy allows users to compete with each other to perform the desired behavior" (p. 1019). The aim of the scale was to measure the preference for competitive strategies, and the Whakataetae scale items were developed for the current research:

Wa	I want my daily steps to be higher than other people
Wb	I prefer physical activities that are competitive with other people.
Wc	I would try to improve my ranking if I could see other people's rankings
Wd	If I am competing against others I would try harder to beat them

8.4.3 SOCIAL CONNECTION (SC)

Measure 3: Does a real-world connection influence persuasive strategy preference? (SC). The aim of Social Connection (SC) was to measure the degree to which an individual wants to include friends and whānau in their hīkoi (walk) to health. The SC construct stems from previous research that stated people from collectivistic cultures perceive themselves as highly inter-connected with others, and the influence of collectivism on behaviour is mediated by values and self-construal (Gudykunst et al., 1996). The current study hypothesises that real-world connections in Māori culture are a predictor of persuasive strategy preference. The SC scale items were adapted from Ting-Toomey et al. (2001).

SCa	My relationships with others are more important than my successes
SCb	I consult with others before making important decisions
SCc	I would sacrifice my self-interest for the benefit of my whānau
SCd	My whānau would influence my decision to begin a hīkoi to health

8.4.4 MĀORI-CENTRIC DESIGN (MCD)

Measure 4: How do the designs resonate with Māori (MCD)? The aim of the Māori-centric design (MCD) construct was to measure the degree to which an individual perceives that the *Hīkoi to Health* prototype reflects tikanga Māori (cultural protocols) and fits a Māori world view reflecting Māori values, people, and practices. The MCD scale items were developed for this research.

MCDa	The illustrations in this app represent Māori people
MCDb	The quests in this app reflect tikanga Māori
MCDc	This app is designed especially for Māori people
MCDd	This app fits well with te ao Māori

8.4.5 PERCEIVED EASE-OF-USE (PEOU)

Measure 5: Do participants perceive the application is easy to use (PEOU)? Perceived Ease-of-Use (PEOU) is a determinant of technology usage (Davis, 1989) and is defined as "the degree to which a person believes that using a particular system would be free of effort" (Davis, 1989, p. 320). The aim of the PEOU construct was to determine the degree to which an individual perceives that the *Hīkoi to Health* prototype would be easy to use. The scale items to measure PEOU were adapted from Davis (1989).

PEOUa	I would find this app easy to learn
PEOUb	I would find this app easy to use
PEOUc	The text in this app makes it easy to know what to do next
PEOUd	This app is something I could see myself using on a regular basis

8.4.6 INTENTION TO USE (IU)

Measure 6: Would the participants trial the app when it became available (IU)? Intention to Use (IU) measures the degree to which an individual predicts they would use the *Hīkoi to Health* application. According to Davis (1989) intention to use a technology is a predictor of actual system usage. The scale items to measure IU were developed for this research.

IUa	I would use this app when it becomes available
IUb	I would recommend this app to my whānau
IUc	I would like to try a real version of this app
IUd	I would recommend this app to other people

8.4.7 PERCEIVED USEFULNESS (PU)

Measure 7: Would the application work for Māori (PU)? Perceived Usefulness (PU) is also a determinant of technology usage, Davis (1989) define PU as "the degree to which a person believes that using a particular system would enhance his or her job performance"

(p. 320). Scale items from Davis (1989) relate to PU as a predictor of technology adoption in the workplace, which are not entirely useful in the current research. However, they were used to guide the scale item development for the current research to measure the degree to which an individual perceives that the *Hīkoi to Health* application would help them become more physically active and to make healthier food choices.

PUa This app would help me become more physically active
PUb This app would help me make healthier food choices
PUc This app would give me confidence to make healthier choices
PUd Using this app would give me ideas for becoming healthier

8.5 DATA COLLECTION AND ANALYSIS

This research uses a quantitative format to determine whether the independent variables effect the dependent variables, and to statistically confirm or test the strength of the relationship between variables. This subsection discusses the development of the survey instrument, pre-release feedback, how I measured face validity, and which statistical techniques I employed to analyse the data.

The survey was created in Qualtrics using the items and measures previously discussed. Prior to launching the survey to the public, I invited nine of the co-design hui participants to complete the survey and conducted Zoom interviews with them. Based on their feedback minor adjustments were to the instructions. I also changed the sequence of some items, added page numbers, progression counters, and navigation arrows.

One issue encountered at the time of the public launch was that Facebook algorithms determined that the Qualtrics link was unacceptable content and therefore would not let me make the initial posts. I contacted the technical support team at Qualtrics who were unable to resolve the issue. Eventually, I created a landing page on the Māori Health Research website; the landing page contained the ethics information, and when people clicked the I agree button, they were redirected to the Qualtrics survey. While less than ideal, the site switch was virtually unnoticeable to respondents.

8.5.1 SURVEY PROCEDURES

There were three sections to the survey. The first section landed on an ethics page, which gave information about the purpose of the research. It explained that respondents could stop at any time and asked for their agreement to continue. Once respondents agreed, the second page asked qualifying questions: *Do you identify as Māori?* And, *are you over 18?* Although only responses from Māori were sought, we decided that if non-Māori

completed the survey their responses would be collected and not analysed. However, there were no non-Māori respondents. People under the age of 18 were directed to the end-survey screen where they were thanked for their time. The responses were limited to adults aged over 18 as the research did not have ethical approval to survey minors. Respondents who identify as Māori were asked: *which iwi do you belong to?* This data was collected for verification purposes; respondents could add multiple iwi if they wanted to, and could also choose to leave the answer blank.

The second section began with an explanation of what respondents would see on subsequent screens, it explained that they would be shown storyboard designs and would then be asked to agree or disagree with various statements. Respondents were asked to read the text on the storyboards, and further advised that they would not be asked to recall anything specific from the storyboards. The storyboards were previously presented and discussed in *Section 7.5: Artefact Design*.

The third section collected demographic information such as age, gender, whānau, and a description of the type of location where the respondent lived. Respondents were not asked to specifically identify their location, rather they were asked to identify whether it was a large or small city, a large or small town, or a rural community. To minimise the risk to anonymity, specific locations were not considered necessary. The survey did not ask for information about income or education level, as this was not considered relevant to the research aims.

8.5.2 FACE VALIDITY

Face validity is the perceived appropriateness and relevance of a survey and its items by the persons taking the survey (Holden, 2010). To determine face validity of the survey and the individual items, I invited four participants from the co-design hui to take the survey and then conducted an online interview with each person separately using Zoom. The objectives of these interviews were to determine the opinion of respondents about the purpose of the survey and whether they understood the item and survey structure. Respondents suggested that the aims of the study were to test whether they preferred exercising with other people, preferred competition over cooperation, and whether the prototype designs would appeal to Māori people. Essentially, these were four of the key constructs that the survey seeks to measure. Holden (2010) suggests that face validity is based on the judgements of survey respondents, not domain experts. Therefore, the fact that interview participants did not raise the concepts of *intention to use*, *Perceived Ease-of-Use,*

or *perceived-effectiveness* did not invalidate those constructs as the scale items relate to the theoretical model adopted for the study.

8.5.3 DATA ANALYSIS

All data analysis was carried out using SPSS software, version 28.0. To prepare the data for analysis a series of activities: The file was up in SPSS; each variable was defined; out-of-range values were checked; scale items were checked for reliability; new values for scale items were calculated; and missing values were replaced. Analysis began once the data were ready.

8.5.3.1 FACTOR ANALYSIS

Factor analysis is a statistical technique used to validate new scale items (Fein et al., 2022). It is used in the current research for all scale items as they are adapted from previous scale items or developed specifically for this survey. Factor analysis was conducted using the principal components method and a varimax rotation. Factors with an Eigenvalue greater than 1 were retained, as were items that loaded primarily on .5 or higher, and a secondary loading of no more than .2 lower than the primary loading. Reliability analysis to ensure the items are consistent and follow the completion of factor analysis.

8.5.3.2 RELIABILITY ANALYSIS

Internal consistency reliability measures the consistency of scale items within a test. It tests the extent to which individual items within a scale appear to measure the same construct (Fein et al., 2022). Internal consistency is measured with Cronbach's alpha, which is a statistic calculated from the correlations between items. Generally, a Cronbach's alpha between $0.6 \leq \alpha < 0.69$ is minimally acceptable; between $0.7 \leq \alpha < 0.79$ is considered good; between $0.8 \leq \alpha < 0.89$ is very good; and over 0.9 is excellent. I ran separate reliability analyses for each of the scales, and all scales were between minimally acceptable, and excellent. Two scales were between $0.6 \leq \alpha < 0.69$ and I checked the output to determine what the impact would be if an item were deleted. In both instances, Cronbach's alpha would have reduced below 0.6 so the items were not removed. Once scales were validated, and tested for internal consistency, I computed a new value for each variable by calculating the average mean of scale items. This allows for better measurement and comparison between variables.

8.5.3.3 DESCRIPTIVE STATISTICS

Descriptive Statistics summarise and provide information about the data. They are also used to calculate confidence intervals. *Confidence Intervals* indicate a degree of accuracy that a sample mean is representative of the general population and are presented as a 95% confidence interval that the true mean for a scale lies between two standard deviations of the calculated mean. I also conducted *Independent Sample T-Tests* to determine the relationships between independent variables and a dependent variable. Specifically, I tested whether there were significant gender differences within each construct using Levene's test for equality of variances, and equal variances not assumed. A *Paired Sample T-Test* was conducted to determine whether the difference in means between two related variables was statistically significant. Specifically, to analyse the differences between the means of Mahi Tahi and Whakataetae.

8.5.3.4 CORRELATION

Correlation measures the strength and direction of the relationship between two continuous variables. Bivariate correlation analysis was conducted using Pearson's correlation coefficient and two-tailed significance tests. The correlation tables showed that all correlations are significant with 99% certainty the results were not due to sampling variance or random probability. Pearson's correlation method shows a value for the relationship between variables of in the range of -1 (negative correlation) and +1 (positive correlation). A 0 value represents that there is no relationship between variables, and the closer the value to -1 or +1, the stronger the relationship.

8.5.3.5 REGRESSION

The main aim of this analysis is to determine which of the six independent variables: MT, W, SC, MCD, PU and PEOU, predict the dependent variable: IU. Multiple regression identifies the best combination of predictors and highlights which independent variables are the most important. I conducted multiple linear regression using a forward method. The multiple regression procedure determines which independent variables account for the most variance in the dependent variables, it does this by loading them into the model one at a time. The calculation cycle stops when there are no more variables that account for significant variance. Variance is represented as R^2, which explains the extent to which one variable predicts the other. I conducted separate regression analysis for each dependent variable.

8.6 CHAPTER SUMMARY

This chapter has explained the research design for Phase Two of the current research project. It has explained why a cross-sectional survey design is an appropriate method to collect data about the *Hīkoi to Health* prototype. *Section 8.2* briefly discussed ethical considerations, and the ways this study is grounded in Kaupapa Māori. This chapter also describes participant sampling, specifically, how participants were selected and recruited. *Section 8.4* describes the measures for each scale and describes how scale items were developed. The final subsection has described the data collection and analysis decisions. It begins by describing how the survey instrument was created, and the methods adopted for pre-testing the constructs. *Section 8.5.3* has outlined and justified each of the data analytics techniques that were used on the data. The next chapter will report the results of the analysis.

CHAPTER NINE: PHASE TWO RESULTS AND DISCUSSION

The aims of this current phase are to determine how well the prototype designed in Phase One meets the needs of Māori. More specifically, which factors predict Perceived Usefulness, and Intention to Use; both important aspects of technology adoption. This chapter presents the statistical results of the cross-sectional survey, and it begins by presenting factor analysis results for the measurement scales in *Section 9.1*, followed by reliability analysis in *Section 9.2*. These results are followed by *Section 9.3* which presents descriptive statistics, paired sample t-tests, and correlations, followed by multiple regression analysis in *Section 9.4*. Discussion relating to these results is presented in *Section 9.5*, which evaluates the *Hīkoi to Health* prototype. Finally, *Section 9.6* interprets the results from *Sections 9.1 to 9.5* to discuss and evaluate the *Hīkoi to Health* prototype design. This section explains why Perceived Ease of Use; Māori-Centric Design; and the use of Whakataetae (competitive) persuasive strategies in the design of a smartphone application to support positive health behaviour change for Māori are the most effective, and it relates this discussion to previous literature and behaviour change theory.

9.1 FACTOR ANALYSIS

One purpose of factor analysis is to reduce many items into fewer factors by analysing variance between items, and to converge variables into groups that statistically fit together. It is used to determine that scale items measure a single construct and that all items within a scale are statistically related to each other. Table 9.1 shows that rotation converged in 6 iterations, and 28 items converged into six factors accounting for 66.16% of the variance. The table displays the primary and secondary loadings only. Descriptions for each scale item were presented in *Section 8.4: Measures*. Items that load cleanly under the same factor are assumed to be related. Factor analysis testing determined that two items did not load cleanly: MCDd (Māori-Centric Design, item d) loaded primarily on Factor 5 (.593), and secondarily on Factor 1 (.412), which is less than .2 from the primary loading. Therefore, MCDd is removed from further analysis. A different item, SCd (Social Connection, item d) had a primary loading of .474 which is below minimum loading value. However, it was determined that this item should be retained as when the item is removed Cronbach's alpha for that scale is below 0.6 which indicates the entire scale is unreliable. As Social Connection is an important factor in the model for Phase Two (see Figure 8.2), it is important to retain that factor. PEOUd (Perceived Ease of Use) loads cleanly alongside

items PUa,b,c,d (Perceived Usefulness) and items IUa,b,c,d (Intention to Use). Therefore, nine items were combined into a single factor renamed *Expected App Usage* (EAU).

Table 9.1

Factor analysis

Rotated Component Matrix [a]						
	1	**2**	**3**	**4**	**5**	**6**
PUb	**.858**					
PUc	**.833**					
PUa	**.827**					
IUa	**.814**					
PUd	**.804**					
PEOUd	**.740**		.354			
IUc	**.704**					
IUb	**.690**		.479			
IUd	**.681**		.385			
Wd		**.871**				
Wb		**.834**				
Wc		**.786**				
Wa		**.716**				
PEOUa			**.846**			
PEOUb			**.834**			
PEOUc	.327		**.703**			
MTa				**.808**		
MTd				**.775**		
MTb				**.700**		
MTc				**.626**		
MCDc					**.713**	
MCDb	.302				**.695**	
MCDa					**.687**	
MCDd	.412				.593	
SCc						**.757**
SCa						**.725**
SCb					.322	**.551**
SCd						.474

Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.
a. Rotation converged in 6 iterations.

Factor analysis has determined the original 28 items are measuring six unique factors, and these will be used for further analysis:

Factor 1: Expected App Usage: (PEOUd + PUa,b,c,d + IUa,b,c,d)

Factor 2: Whakataetae (Competition): Wa,b,c,d

Factor 3: Perceived Ease of Use (PEOUa,b,c)

Factor 4: Mahi Tahi (Cooperation) (MTa,b,c,d)

Factor 5: Māori-Centric Design (MCDa,b,c)

Factor 6: Social Connection (SCa,b,c,d)

Following factor analysis, reliability analysis was conducted to test the extent to which individual items within a scale appear to measure the same construct. Table 9.2 presents

internal consistency reliability, Cronbach's alpha and the number of items for each factor. All scales had a minimally acceptable Cronbach's alpha.

Table 9.2

Internal consistency reliability

Factor	Cronbach's Alpha	N of Items
Factor 1: Expected App Usage	.940	9
Factor 2: Whakataetae (Competition)	.858	4
Factor 3: Perceived Ease of Use	.864	3
Factor 4: Mahi Tahi (Cooperation)	.768	4
Factor 5: Māori-Centric Design	.685	3
Factor 6: Social Connection	.624	4

9.2 DESCRIPTIVE STATISTICS

This subsection first describes the sample, then, it presents confidence intervals for each factor. In the current study, descriptive statistics are provided to summarise characteristics of the survey respondents. All respondents (N=377) identified as Māori. Table 9.3 shows that 377 respondents completed the survey; of these, 41 identify as tāne (male) representing 10.9% of the sample. Additionally, 325 respondents identify as wahine (female), this represents 86.2% of the sample. A further 11 individuals (2.9%) either identify as tāhine (non-binary), or elected not to answer this question.

Table 9.3

Frequencies: Gender

	Frequency	Percent	Valid Percent
Tāne (male)	41	10.9	10.9
Wahine (female)	325	86.2	86.2
Tāhine (non-binary)	5	1.3	1.3
Prefer not to say	6	1.6	1.6
Total	**377**	**100.0**	**100.0**

Table 9.4 shows the age frequency of respondents. Data was only collected from respondents aged over 18. This table shows that 189 respondents (50.1%) were aged between 35 and 54 years. The lowest frequencies of respondents are aged between 18 and 24 years, and over 65 years.

Table 9.4

Frequencies: Age

Age	Frequency	Percent	Valid Percent
18-24 years	16	4.2	4.2
25-34 years	75	19.9	19.9
35-44 years	101	26.8	26.8
45-54 years	88	23.3	23.3
55-64 years	80	21.2	21.2
65 years and over	17	4.5	4.5
Total	**377**	**100.0**	**100.0**

Confidence levels indicate how well the mean for any variable calculated from the sample is representative of the whole population with a 95% probability. Table 9.5 shows the calculated sample mean for each factor. The highest mean value was attributed to Perceived Ease of Use (4.411), and the lowest mean was for Whakataetae (competition) (3.2052). All values were above the midpoint and most are close to 4.0 which represents the *I agree* point on the response scale.

Table 9.5

Confidence intervals

Descriptives	Mean	Lower / Upper Bound
Perceived Ease of Use	**4.411**	4.345 / 4.476
Mahi Tahi (Cooperation)	**3.940**	3.856 / 4.023
Social Connection	**3.938**	3.865 / 4.011
Expected App Usage	**3.920**	3.842 / 3.998
Māori-Centric Design	**3.874**	3.800 / 3.947
Whakataetae (Competition)	**3.205**	3.106 / 3.304

One aim of Phase Two is to determine whether respondents preferred Whakataetae (Competition) or Mahi Tahi (Cooperation). A paired sample t-test was conducted to determine whether the difference in means between these two variables is statistically significant. Table 9.6 shows that the average difference between Mahi Tahi and Whakataetae was .839, and that this difference is significant ($p<.001$).

Table 9.6

Paired samples test

	Paired Differences			Significance	Significance
	95% Confidence Interval of the Difference				
	Upper	t	df	One-Sided p	Two-Sided p
Mahi Tahi - Whakataetae	.839	13.795	376	<.001	<.001

9.3 CORRELATION ANALYSIS

Correlation describes the direction and strength of a relationship between variables. In the current research all correlations were positive. Table 9.7 shows a fair degree of positive correlation between Expected App Usage (EAU) and both Perceived Ease of Use (PEOU) (.516) and Māori-Centric Design (.429). It also shows a smaller correlation between EAU and Whakataetae (competition) (.319), and Mahi Tahi (cooperation) (.293). Additionally, there is a moderate relationship between PEOU and Māori-Centric Design (.428, p<.01). The correlation between PEOU and Whakataetae (competition) is negligible (.189), although still statistically significant. The relationship between Māori-Centric Design and Whakataetae (competition) is .283, which is lower than the relationship between Māori-Centric Design and Mahi Tahi (cooperation) (.307). The relationship between Mahi Tahi (cooperation) and Whakataetae (competition) is .351, and between Mahi Tahi (cooperation) and PEOU it is .235. Social Connection is most strongly related to Mahi Tahi (cooperation), at .377, followed by Māori-Centric Design (.349), PEOU (.267), EAU (.237), and Whakataetae (.232). All these relationships are significant at p=<.01.

Table 9.7

Correlations

		Expected App Usage	Whakataetae (Competition)	Perceived Ease of Use	Mahi Tahi (Cooperation)	Māori-Centric Design	Social Connection
Expected App Usage	Pearson Correlation	--					
	Sig. (2-tailed)						
	N	377					
Whakataetae (Competition)	Pearson Correlation	**.319****	--				
	Sig. (2-tailed)	<.001					
	N	377	377				
Perceived Ease of Use	Pearson Correlation	**.516****	**.189****	--			
	Sig. (2-tailed)	<.001	<.001				
	N	377	377	377			
Mahi Tahi (Cooperation)	Pearson Correlation	**.293****	**.351****	**.235****	--		
	Sig. (2-tailed)	<.001	<.001	<.001			
	N	377	377	377	377		
Māori-Centric Design	Pearson Correlation	**.429****	**.283****	**.364****	**.307****	--	
	Sig. (2-tailed)	<.001	<.001	<.001	<.001		
	N	377	377	377	377	377	
Social Connection	Pearson Correlation	**.237****	**.232****	**.267****	**.377****	**.349****	--
	Sig. (2-tailed)	<.001	<.001	<.001	<.001	<.001	
	N	377	377	377	377	377	377

**. Correlation is significant at the 0.01 level (2-tailed).

9.4 REGRESSION ANALYSIS

This subsection presents the results of multiple regression analysis. *Section 9.4.1* presents results relating to whether Social Connection (SC) predicts a user's preference for Mahi Tahi (cooperation) or Whakataetae (competition). *Section 9.4.2* presents results relating to which factors presented earlier in *Section 9.1: Factor Analysis*, effectively predict Expected App Usage.

9.4.1 SOCIAL CONNECTION AS A PREDICTOR OF MAHI TAHI AND WHAKATAETAE

The model for this study presented in *Chapter Eight* (see Figure 8.1) hypothesised that Social Connection (SC) is a predictor of Mahi Tahi (cooperation) and/or Whakataetae (competition). SC is related to both Mahi Tahi (cooperation) and Whakataetae (Competition), and both relationships are statistically significant. As Mahi Tahi (cooperation) and Whakataetae (Competition) are both dependent variables, therefore, single linear regression was conducted for each variable using SC as the independent variable.

Table 9.8 summarises the model for the influence of SC on Mahi Tahi (cooperation); it provides R and R^2 values. The R value is .302, which indicates a slight degree of correlation between the variables. The R^2 value indicates how much of the total variation in the dependent variable, Mahi Tahi (cooperation), can be explained by Social Connection. In this case, R^2 is .091 which indicates that Social Connection explains 9% of the variance in Mahi Tahi (cooperation).

Table 9.8

Model summary: Social Connection to Mahi Tahi

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.302[a]	.091	.089	.78479

a. Predictors: (Constant), Social Connection

Table 9.9 summarises the model for the influence of SC on Whakataetae (competition) and presents the R and R^2 values of the Social Connection to Whakataetae (competition) relationship. The R value is .182, which indicates a negligible degree of correlation between the variables. The R^2 shows that only 3% of the total variation in Whakataetae (competition) can be explained by Social Connection.

Table 9.9

Model Summary – Social Connection to Whakataetae

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.182[a]	.033	.031	. 96319

a. Predictors: (Constant), Social Connection

9.4.2 PREDICTORS OF EXPECTED APP USAGE

Given that all the relationships with Expected App Usage were statistically significant, multiple regression was used to determine which of these factors accounted for unique variance in Expected App Usage (i.e. the dependent variable). Table 9.10 presents a summary of the regression models. For Model *1* the predictor is Perceived Ease of Use and R=.518. *Model 2* includes two predictors: Perceived Ease of Use and Māori-Centric Design (R=.578); and *Model 3* includes the predictors: Perceived Ease of Use, Māori-Centric Design, and Whakataetae (Competition) (R=.603). The adjusted R^2 of this final model is .358. Mahi Tahi (cooperation) and Social Connection are not entered in the model as they do not significantly predict Expected App Usage over and above the other predictors.

Table 9.10

Model summary: Predictors of EAU

Model	Variables Entered	R	R Square	Adjusted R Square
1	Perceived Ease of Use	.518[a]	.267	.267
2	Māori-Centric Design	.578[b]	.334	.330
3	Whakataetae (Competition)	.603[c]	.363	.358

a. Predictors: (Constant), Perceived Ease of Use

b. Predictors: (Constant), Perceived Ease of Use, Māori-Centric Design

c. Predictors: (Constant), Perceived Ease of Use, Māori-Centric Design, Whakataetae (Competition)

Table 9.11 provides the analysis of variance in the models presented previously. The final model was statistically significant, $F(3,373)=70.357$, $p<.001$.

Table 9.11

ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	59.178	1	59.178	136.782	<.001[b]
	Residual	160.943	372	.433		
	Total	220.121	373			
2	Regression	73.512	2	36.756	93.012	<.001[c]
	Residual	146.609	371	.395		
	Total	220.121	373			
3	Regression	79.958	3	26.653	70.357	<.001[d]
	Residual	140.163	370	.379		
	Total	220.121	373			

a. Dependent Variable: Expected App Usage
b. Predictors: (Constant), Perceived Ease of Use
c. Predictors: (Constant), Perceived Ease of Use, Māori-Centric Design
d. Predictors: (Constant), Perceived Ease of Use, Māori-Centric Design, Whakataetae (Competition)

The unstandardised and standardised coefficients for the models are presented in Table 9.12. These coefficients illustrate a positive and significant linear relationship between each of the predictors and Expected App Usage.

Table 9.12

Coefficients of Expected App Usage

Model		Unstandardised Coefficients		Standardised Coefficients		
		B	Std. Error	β	t	Sig.
1	(Constant)	1.206	.234		5.146	<.001
	Perceived Ease of Use	.616	.053	.518	11.695	<.001
2	(Constant)	.598	.246		2.433	.015
	Perceived Ease of Use	.496	.054	.418	9.174	<.001
	Māori-Centric Design	.294	.049	.274	6.023	<.001
3	(Constant)	.425	.244		1.740	.083
	Perceived Ease of Use	.475	.053	.400	8.938	<.001
	Māori-Centric Design	.245	.049	.230	5.003	<.001
	Whakataetae (Competition)	.140	.034	.179	4.125	<.001

a. Dependent Variable: Expected App Usage

In the previous subsections, various statistical results have been presented: Descriptive statistics; confidence intervals; factor analysis; reliability analysis; correlations; and, multiple regression analysis. The main interest in this phase is to evaluate the perceived effectiveness of the *Hīkoi to Health* prototype, and to determine which design features would lead to expected usage of the prototype. In the current study, Expected App Usage (EAU) is a factor determined by factor analysis that includes PU and IU. Multiple regression found that three factors: PEOU, MCD, and Whakataetae (Competition), significantly explain EAU. These results will be discussed in *Sections 9.5 and 9.6.*

9.5 EVALUATING THE *HĪKOI TO HEALTH* PROTOTYPE

The model developed for evaluating the *Hīkoi to Health* application was originally presented in Figure 8.2, which stated that Social Connection (SC) could predict a user's preference for Mahi Tahi (cooperation) or Whakataetae (competition). The model also suggested the variables: Mahi Tahi (cooperation), Whakataetae (competition), Māori-Centric Design (MCD) and Perceived Ease of Use (PEOU), could predict Intention to Use (IU), and Perceived Usefulness (PU). This subsection addresses the validity of the

model presented in *Section 8.4: Measures* by answering each of the guiding questions used to develop the measures presented in *Section 8.4*. To recap, these questions were:

Measure 1: Is there a preference for cooperative (MT) persuasive strategies?
Measure 2: Is there a preference for competitive (W) persuasive strategies?
Measure 3: Does a real-world connection influence persuasive strategy preference (SC)?
Measure 4: How do the designs resonate with Māori (MCD)?
Measure 5: Do participants perceive the application is easy to use (PEOU)?
Measure 6: Would the participants trial the app when it became available (IU)?
Measure 7: Would the application work for Māori (PU)?

Section 9.5.1 addresses Measures 1 and 2; *Section 9.5.2* relates to Measure 3; *Section 9.5.3* explores Measure 4; *Section 9.5.4* explains Measure 5; and finally, *Section 9.5.5* discusses both Measure 6 and Measure 7.

9.5.1 PERSUASIVE STRATEGY PREFERENCE

The question of a persuasive strategy preference can be partially addressed by comparing the means for each scale. The mean for Mahi Tahi (cooperation) is 3.940, this is higher than the mean for Whakataetae (competition) (3.205), which shows that respondents more frequently agreed with Mahi Tahi preference statements than Whakataetae (competition) statements. The results of a paired sample t-test presented previously on Table 9.6 shows that the mean differences between Mahi Tahi and Whakataetae is statistically significant. This finding was expected, and confirms findings in Phase One (see *Section 7.3.1: Whakataetae (competition) and Mahi Tahi (cooperation)* for discussion) which stated that people from collectivist cultures are more likely to be susceptible to cooperative strategies, and that collectivists prefer cooperative strategies in persuasive technologies more than competitive strategies (Oyibo & Vassileva, 2019). This is an important design consideration as Whakataetae (competition) is a commonly deployed gamification element, based on the assumption that most people are competitive (Oinas-Kukkonen & Harjumaa, 2009; Orji, Nacke, et al., 2017) which is not the case for Māori.

9.5.2 THE ROLE OF SOCIAL CONNECTION

The current research hypothesises that real-world social connections in Māori culture are a predictor of persuasive strategy preference. To address whether the hypothesis is correct, it is necessary to consider the correlations between each of these factors. The strongest correlation between Social Connection (SC) and any other factor occurs with

Mahi Tahi (cooperation), at .377. In contrast, the weakest correlation against SC is with Whakataetae (competition) at .232. Both relationships are significant at p=<.01. This finding indicates that there is a positive relationship between an individual's real-world connections and their preference for Mahi Tahi (cooperation) strategies. However, these relationships are not particularly strong.

Simple linear regression to determine if Social Connection might predict Mahi Tahi (cooperation) and/or Whakataetae (competition) showed the R^2 value for Mahi Tahi (cooperation) is .091, and the R^2 value for Whakataetae (competition) is .033. These values indicate the degree of variation between the dependent variables that can be explained by Social Connection. Therefore, the current research finds that SC predicts a stronger preference for Mahi Tahi (cooperation) than Whakataetae (competition), although these values are slight to moderate at best.

This finding is somewhat surprising as it appears to contradict the findings in Phase One of the current research which suggested that familial relationships and the expectations of whānau would encourage Māori to collaborate on achieving common goals. A further finding originally presented in *Section 6.2: Research Question 2*, shows a relationship between the degree of Social Connection between users and the degree of cooperativeness or competitiveness they will prefer when using a gamified technology. Additionally, these previous findings suggested that some Māori users may prefer cooperation with close social contacts and prefer competition against strangers. This earlier finding was supported in the literature which stated that individuals in a collectivist culture undertake actions for the group's benefit (Triandis, 1993), so therefore, are more likely to prefer to work cooperatively. These findings suggested that persuasive strategy preference is moderated by social connection. Furthermore, Triandis (1989, 1993) also found a preference for competition with outgroup members. An example of *outgroup status* in Māori society is the perceptions members of a whānau (family) or iwi (tribal group) have toward people who they do not consider to be part of their ingroup (their own whānau, or their own iwi). Triandis (1993) also stated that these perceptions may be a result of a lack of trust or tension between individuals or groups (Triandis, 1989).

The SC scale items used in the current research were adapted from Ting-Toomey et al. (2001), and stem from the assumption that people from collectivist cultures have highly inter-connected relationships with others, and, that the influence of collectivism on behaviour is mediated by normative beliefs and self-construal (Gudykunst et al., 1996). One possible explanation of why SC does not predict either Mahi Tahi (cooperation) or

Whakataetae (competition) is indicated in *Section 9.5.1*: *Persuasive Strategy Preference* which showed that all scale items for Social Connection did not load cleanly, and that with item SCd removed, Cronbach's alpha was below .6 indicating an inconsistency of responses for that scale. A low alpha value may be attributed to low number of test items or low inter-relatedness between items (Tavakol & Dennick, 2011). The scale was retained even though it was unreliable because it was important to test the original hypothesis that real-world social connections in Māori culture predict persuasive strategy preference.

9.5.3 MĀORI-CENTRIC DESIGN

To evaluate the prototype, respondents were asked whether the designs resonate with Māori. The respondents agreed that the prototype was specifically designed for Māori people, and that the design reflects tikanga Māori (cultural protocols) and fits well with te ao Māori. This study finds that MCD is an important factor in designing Māori mHealth interventions, this is evidenced by the strength of the correlation between MCD and Expected App Usage (EAU). The Māori-centric co-design process allows researchers to understand the aspirations of Māori, and to understand the models of wellbeing that are specific to Māori (Ni Mhurchu et al., 2019).

Tailoring health behaviour change interventions toward the specific needs of the target audience rather than assuming a one-size-fits-all approach is critical and can support improved physical activity and nutrition for Indigenous and minority groups (Eyles et al., 2016). Ni Mhurchu et al. (2019) stated that a co-design process leads to cultural tailoring and creates a sense of ownership among target users, which may also be a useful aspect of use intentions. Culturally-tailored health behaviour change interventions are generally more effective for Indigenous and minority populations (Osei-Assibey et al., 2010). Furthermore, previous research has shown that culturally-tailored health behaviour interventions can support positive health behaviour change (Stolley et al., 2009), specifically in relation to supporting increased physical activity and healthy lifestyle choices.

9.5.4 PERCEIVED EASE OF USE

A factor that has previously been identified as an antecedent of Expected App Usage in technology research is Perceived Ease of Use (PEOU) (Davis, 1989). Respondents frequently agreed with statements relating to their beliefs that they would find the prototype simple to use if it were developed as a working application. The PEOU construct measured the degree to which participants perceived they would find the *Hīkoi*

to Health prototype easy to learn and to use. Respondents also agreed that the design of the application meant that users would know what they needed to do next, and that they could see themselves using the application on a regular basis.

In the current research EAU differs from *behavioural intention* on the RAA model as it does not consider attitude, social norms, or perceived behavioural control, which Ajzen (2012); and Fishbein (2008) contend are influencers of behavioural intention. However, EAU could be considered a proxy for BI in the sense that intention is an antecedent of actual behaviour (Ajzen et al., 2018; Fishbein & Ajzen, 1975, 2011), and respondents generally agreed they would use the *Hīkoi to Health* application.

9.5.5 EXPECTED APP USAGE

Earlier in Section 9.5, it was stated that the effectiveness of *Hīkoi to Health* prototype could be addressed through *Measure 6: Would the participants trial the app when it became available (IU)?* and *Measure 7: Would the application work for Māori (PU)?* However, factor analysis results presented in *Section 9.1: Factor Analysis,* showed that Intention to Use (IUa,b,c,d), Perceived Usefulness (PUa,b,c,d), and one item from Perceived Ease of Use (PEOUd) appear to measure the same construct. These variables were combined into Factor 1, which was relabelled: *Expected App Usage* (EAU). One possible explanation for this convergence is that the scale items for IU were developed for the current research, and thus had not been validated in prior research. However, it is still possible to answer the questions posed by *Measures 6* and *7* using the mean of EAU (3.920), this figure indicates that typically, most respondents selected *I agree* for statements relating to perceived usefulness, and intention to use the interactive *Hīkoi to Health* application when it becomes available. This indicates that generally, respondents had a positive attitude toward using the application. Davis (1989) stated that PU and PEOU have a direct influence on attitude, and that attitude is an antecedent of behavioural intention (BI). In the Reasoned Action Approach (Technology) framework adopted for the current research, an individual's beliefs about performing the behaviour also have a direct effect on attitude (Ajzen et al., 2018; Fishbein & Ajzen, 1975, 2011).

The purpose of *Section 9.5* has been to evaluate the *Hīkoi to Health* prototype against the evaluation criteria presented in *Chapter Eight: Phase Two Research Design* and in *Section 5.1.2.2: Activity Two: Define the Objectives of a Solution*. These criteria were:

1. To ensure the design includes the most effective persuasive strategies for Māori;
2. To design an application that employs appropriate game design elements; and,

3. To ensure the design is culturally appropriate and meets the needs of the target population.

The effectiveness of the *Hīkoi to Health* prototype can be evaluated by determining whether Māori perceive that they would find the technology easy to use (PEOU) and whether they perceive that they would use the application. In general, respondents agreed that they would use and recommend the application, and that they believe that the application would help them to make healthier decisions such as increased physical activity, and to make healthier food choices.

In summary, the respondents' perceptions of *Hīkoi to Health* prototype appear to support the notion that the design meets the evaluation criteria previously described. The findings show that four factors are important in the *Hīkoi to Health* prototype: a cooperative persuasive strategy; that the prototype appears to be easy to use; the application appeals to users because of its Māori-centric design; and in general respondents agree that the application would be effective, and that they would use it. However, this evaluation has not explained which of these factors is the most important, nor which of these factors effectively predict the target behaviour. The next subsection discusses the predictors of EAU.

9.6 PREDICTING EXPECTED APP USAGE

As previously discussed, factor analysis converged IU and PU into a single factor: *expected app usage* (EAU). Therefore, the rest of this section will discuss the effectiveness of the independent variables to predict EAU despite the original hypothesis claiming separate dependent variables. The current research contends that EAU can be directly influenced by Mahi Tahi (cooperation), Whakataetae (competition), Māori-Centric Design, and Perceived Ease of Use (PEOU), and indirectly influenced by Social Connection (SC).

Multiple regression analysis determined that the predictors of EAU are PEOU, Māori-Centric Design, and Whakataetae (competition), and that the contribution of these three variables was statistically significant at $p<.001$. R^2 in the final model is .363, meaning that 36.3% of the variation in EAU is explained by PEOU, Māori-Centric Design and Whakataetae (competition). Two additional factors were excluded from the final model because they do not significantly predict EAU, these were Mahi Tahi (cooperation), and social connection. Discussion on the implications of each predictor is presented in the following subsections.

9.6.1 PERCEIVED EASE OF USE

The current research found that the strongest correlation is between Perceived Ease of Use (PEOU) and expected app usage (EAU). This finding appears to support earlier research which stated that PEOU is a causal antecedent of Perceived Usefulness (PU) (Davis, 1989). Although attitude is not specifically measured in the current research Davis (1989) contends that PEOU has a significant impact on attitude, explaining that when a technology is simple to use, individuals will develop a positive attitude toward the technology, which in turn has a significant impact on the expectation that users will use the technology.

In the current research, the *Reasoned Action Approach* (Ajzen et al., 2018) framework was adapted (see Figure 2.11 for RAA (Technology) to include technology specific factors from the *Technology Acceptance Model* (Davis, 1989) specifically to measure an individual's perceptions about the technology's usefulness (PU) and ease of use (PEOU). Davis et al. (1989) argued that PU and PEOU positively impact attitude, and *attitude* predicts behavioural intention (BI). However, TAM ignores the contributing effects of normative beliefs and perceived behavioural control on BI. In the current research, PEOU contributed significantly to EAU, which might indicate that the RAA (Technology) model requires further investigation to determine its usefulness in applied health technology research.

9.6.2 MĀORI-CENTRIC DESIGN

The purpose of the Māori-Centric Design (MCD) construct was to understand the degree to which MCD influences a user's perceptions of the *Hīkoi to Health* prototype, and the degree to which MCD influences a user's Intention to Use the application. The results previously showed a moderate and positive correlation between MCD and Expected App Usage (EAU), which means that the relationship is positive, and statistically significant. Therefore, this shows that Māori-centric design is a critical factor for the adoption of health behaviour change technology by Māori individuals. This is entirely expected and confirms the previous work of Māori-health research teams (Eyles et al., 2016; Ni Mhurchu et al., 2019; Oetzel et al., 2017; Te Morenga et al., 2018; Theodore et al., 2015; Verbiest et al., 2018).

Through the adoption of Kaupapa Māori, this research prioritises the Māori right to self-determination by respecting Māori customs, Māori history, Māori development, and Māori aspirations (Oetzel et al., 2017). This Māori world view has guided the entire research project; it has empowered Māori to participate and co-create an intervention aimed at

supporting positive health outcomes for Māori. Te Morenga et al. (2018) explain that culturally-tailored behaviour change interventions are more effective for Indigenous populations, and this principle has driven every decision in the current research project. *Hīkoi to Health* is designed by Māori, for Māori. The Māori-Centric Design (MCD) construct measures the degree to which an individual perceives that the *Hīkoi to Health* prototype reflects tikanga Māori (cultural protocols) and fits a Māori world view reflecting Māori values, people, and practices. In the current research, Māori-centric design relates to the design of the programme of research as well as the design of the *Hīkoi to Health* prototype itself.

9.6.3 WHAKATAETAE (COMPETITION)

It is somewhat interesting that Whakataetae (competition) predicts Expected App Usage because although respondents appear to prefer Mahi Tahi (cooperation) as a persuasive strategy, it is Whakataetae (competition), that statistically significantly contributes to the prediction of EAU in the *Hīkoi to Health* prototype. One possible explanation of this is the prototype designs visually represented aspects of *social comparison* in both the Mahi Tahi (cooperation) and Whakataetae (Competition) through the use of game design elements such as points, badges, and leaderboards, and that potentially these elements have been perceived by respondents as competitive elements. Fogg (2003) stated that social comparison motivates users to perform better against people they perceive are similar to them, and Festinger (1954) found that people are motivated to evaluate their own performance by comparing themselves with others, and that comparisons affect the individual's behaviour. An interpretation of this finding is that the inclusion of competitive elements is critical to the design of health behaviour change interventions for Māori. The importance of social comparison and competitive game design elements is echoed in Hamari (2013) who stated that *social comparison* is a fundamental design feature in gamified applications, and directly affect behavioural outcomes.

Another possible explanation of the finding that Whakataetae (competition) may predict EAU is that the construct of Māori-Centric Design already captured the Mahi Tahi (cooperation) aspect because Māori cultural values and perceived norms, as previously discussed in *Section 7.1: Understanding Māori Social Context*, were already inherent in the *Hīkoi to Health* prototype. Whereas Whakataetae (competition) is a unique contributor to the multiple regression model. *Section 7.3.1: Whakataetae (Competition) and Mahi Tahi (Cooperation)* discussed the relationships between inter-whānau and intra-whānau competition, suggesting that it is important in Māori society, but less so than Mahi Tahi.

This subsection has discussed the predictors of expected app usage (EAU). It has shown that three key factors predict whether Māori intend to use the *Hīkoi to Health* application: Perceived Ease of Use, Māori-centric design, and Whakataetae (competition). These factors account for 36.3% of the variation in EAU. The next subsection discusses the implications of the current research from a theoretical and a practical perspective.

9.7 CHAPTER SUMMARY

Chapter Nine presented the results of statistical analyses conducted on the data from the cross-sectional survey. Statistical techniques conducted included factor analysis; this analysis determined that the 28 items presented in *Chapter Eight* measured six unique factors. Using the principal components and a varimax rotation method of factor analysis, it was determined that the scales for Perceived Usefulness and Intention to Use should be combined into one factor: Expected App Usage. Reliability analysis was conducted to determine the degree to which items within a scale appear to measure the same construct consistently. Using Cronbach's alpha, it was determined that all factors exceeded 0.6, and therefore all factors were retained for further analysis.

Descriptive statistics were presented to describe the sample, and confidence intervals showed that the mean for each of the variables was above the midpoint, and most were close to 4.0. which represented the *I agree* statements on the scale measures. Statistical tests to determine the association between variables were also performed. Correlations illustrated positive, bivariate relationships between all the variables. The main interest in this study is whether the features of the application would lead to Expected App Usage, and in the current study, Expected App Usage is a factor that includes Perceived Usefulness, and Intention to Use. Multiple regression found that three factors: Perceived Ease of Use, Māori-Centric Design, and Whakataetae (Competition), significantly predict Expected App Usage.

CHAPTER TEN: CONCLUSIONS, LIMITATIONS, AND FUTURE RESEARCH

This final chapter has three key purposes: It demonstrates that the overarching research question has been answered; it identifies the key contributions to knowledge made by the current research; and it highlights the limitations of the current research and signifies potential areas for future research.

10.1 CONCLUSIONS

Key conclusions are presented in the following subsections: *Section 10.1* presents conclusions pertaining to important contextual elements that shape Māori health. It presents findings and discussion relating to effective persuasive strategies; and concludes which combinations of game design elements to support specific persuasive strategies. *Section 10.2* discusses the theoretical and practical implications of this research by explaining the factors that most significantly impact the adoption of gamified mHealth applications for Māori, and how the current research contributes to a growing body of knowledge on the co-design of health behaviour change applications for Indigenous populations. *Section 10.3* highlights how the current research contributes to practical knowledge by demonstrating that the identification of the most effective persuasive strategies must be determined for each specific target audience prior to the design of a solution; and iterates that the current research provides guidelines for design processes and design decisions that are driven by the needs and aspirations of the target audience. Finally, *Section 10.4* acknowledges some of the limitations of the current research and presents how future research may mitigate some of these limitations.

10.1.1 KEY CONTEXTUAL ELEMENTS THAT SHAPE MĀORI HEALTH

This study is grounded in Kaupapa Māori; an Indigenous approach to research that normalises Māori ideologies within a culturally-defined space (Pihama, 2012). This research makes a positive contribution to Māori knowledge by honouring the right to tino rangatiratanga (self-determination) and by keeping Māori values, language, culture, and ways of doing things (Pihama, 2012) central to the research. This study contributes to an understanding of the Māori context by using a culturally appropriate co-design process to explore the health aspirations of Māori. This subsection presents conclusions pertaining to important contextual elements that shape Māori health, and in doing so, ensures the linkages between findings, discussion, and the research questions are distinct. *Section 1.1:*

The Aotearoa, New Zealand Context presented a compelling argument that historic and ongoing social injustice (Came, 2014) had significant impacts on Māori health that are still in evidence today. It discussed the failure of subsequent governments to honour Te Tiriti (the Treaty), and in doing so, advance the aims of the dominant Pākehā (non-Māori) and minimised Indigenous control, sovereignty and tino rangatiratanga (self-determination) (Smith, 2021). Pākehā health structures have led to institutional racism, and a health system that fails to support Māori (Came, 2014; Te Morenga et al., 2018).

Findings presented in Phase One showed that the Māori social context is complicated, and that whānau have a strong influence on an individual's behaviour through a complex relationship of social norms, inter familial relationships, and the expectations of referents that impact an individual's motivation to comply with behavioural expectations. Findings also showed that generally, Māori hold a collectivist orientation (Khaled, 2008) and commonly described notions about collective-thinking and behaving in a manner that benefits the whānau by prioritising the collective needs of Māori (Triandis, 1989). This manifested as a generosity mindset (Haar et al., 2019) and willingness to share information to improve the knowledge of Māori and non-Māori. Findings relating to the Māori social context also highlighted that some Māori prefer Mahi Tahi (cooperation) over Whakataetae (competition); a finding that was supported by statistical analysis of the survey data in Phase Two. This has real implications for the design and implementation of gamified health interventions in the future.

10.1.2 EFFECTIVE PERSUASIVE STRATEGIES FOR MĀORI HEALTH INTERVENTIONS

This subsection presents conclusions relating to effective persuasive strategy preferences and ensures that RQ2 has been adequately addressed by the current research. RQ2 specifically asked: *Which persuasive strategies are effective in gamified physical activity and diet interventions for Māori?* This question has been answered across both phases of this research. Findings in Phase One also showed that socially-oriented persuasive strategies such as Mahi Tahi (cooperation) and Whakataetae (competition) were important design factors in health behaviour change interventions for Māori. There was little extant literature on persuasive strategy preference in collectivist societies (Khaled, 2008), and no previous studies undertaken in an Indigenous context. Therefore, this study addresses this knowledge gap. Interestingly, although Māori society is considered collectivist, and Phase One indicated that Mahi Tahi (cooperation) would be the most effective strategy, regression analysis showed that Whakataetae (competition) significantly impacts a user's

expected application usage (EAU). Therefore, it is argued that competitive design strategies are critical in gamification design (Khaled, 2008; Oyibo et al., 2019).

Another important finding from Phase One was that while competition is commonly implemented in gamification instantiations (Orji et al., 2014), Māori appear to prefer cooperative strategies. Statistical analysis undertaken in Phase Two largely supported this finding and showed that some Māori prefer Mahi Tahi (cooperative) strategies when compared to Whakataetae (competitive) strategies. Regression analysis was unable to support the hypothesis that the inclusion of Mahi Tahi (cooperative) would predict users' intentions to use the application. One possible explanation given was that the Māori-Centric Design factor already captured elements of cooperation and therefore Mahi Tahi does not contribute to the *prediction* of Expected App Usage. Whereas, Whakataetae (competition) contributed to the model and predicted whether individuals were likely to use the *Hīkoi to Health* application.

Another significant finding from Phase One was that participants in each of the hui rated Āhuatanga urutau (customisation) as one of the most important persuasive strategies that can encourage users to use the application. Āhuatanga urutau is a critical design feature from two perspectives: the ability of an application to be adapted to support the *individual's* health aspirations; and, a culturally-tailored (Khaled, 2008; Ni Mhurchu et al., 2019) application that has been specifically designed to be Māori-centric. This finding was reiterated in Phase Two when Māori-centric design was found to be the leading predictor of expected application usage.

10.1.3 CONFIGURATIONS OF GAME DESIGN ELEMENTS

Individual game design elements can be configured to support multiple persuasive strategies (Deterding, 2014; Deterding et al., 2015) and it is entirely logical that commonly deployed game design elements such as points, badges, challenges, and leaderboards would be appropriate in a variety of contexts. Persuasive strategy and game mechanic suggestions originally presented on Table 6.7 make a useful contribution to knowledge, and addressed RQ3: *Which configurations of game design elements support specific persuasive strategies for Māori?* The current research answered this question by illustrating that the deployment of game design elements is not prescriptive, and practitioners should focus on identifying the appropriate persuasive strategy for each context, rather than on the game mechanics themselves.

This conclusion contributes broadly to gamification knowledge because it illustrates that gamification is not simply "the use of game design elements in non-game contexts" (Deterding et al., 2011, p. 10). Rather, it is a component of a broader design strategy that begins with understanding the important social and contextual issues of the target population. This perspective also contributes to knowledge about co-designing interventions in a culturally appropriate way by demonstrating that *problem-understanding* is a critical precursor to *problem-solving*.

10.2 THEORETICAL IMPLICATIONS

In the current research, a Kaupapa Māori perspective framed the importance of key constructs in the *Reasoned Action Approach* (Ajzen et al., 2018). The Reasoned Action Approach (RAA) was extended to include technology-specific factors from the *Technology Acceptance Model* (Davis, 1989). This model was previously shown as Figure 2.11 in *Section 2.4.5.1*. Attitude and perceived norms are determinants of behavioural intention (Ajzen et al., 2018), and the RAA (Technology) framework showed that attitude toward a technology is mediated by perceived usefulness and perceived ease-of-use. The current research showed that Māori-centric design (MCD) positively impacts a users' attitude, and that MCD is a determinant of expected application usage (EAU). This research also showed that perceived ease-of-use (PEOU) has a positive association with a users' intention to use the application, which suggests that PEOU is an important factor on the RAA (Technology) framework adopted for this research. The current research has shown that Māori identity is linked to a collectivist culture, and participants perceive that applications designed to encourage users to work together in socially connected groups (Mahi Tahi – cooperation) may be more effective for Māori, it is the use of competitive strategies (Whakataetae – competition) that potentially drives individual's intentions to use the *Hīkoi to Health* application.

According to Ajzen (1991, 2012); Ajzen et al. (2018); and Fishbein and Ajzen (1975), behavioural intention is influenced by perceived norms. Kaupapa Māori means honouring the right to tino rangatiratanga (self-determination), and keeping Māori customs, beliefs, and culture, central to the research. In doing so, this research has explored Māori social norms as an aspect of understanding beliefs and motivations for adopting health behaviour change technologies. The current research has shown that the influence of whānau in Māori society is a determinant of intervention adoption. It has highlighted that some Māori tend toward a collectivist social orientation, and as such favour Mahi Tahi

(cooperation) over Whakataetae (competition). In the current research, the normative beliefs of Māori emphasise the importance of whānau (family) relationships, and that some Māori are motivated to comply with the behavioural expectations of whānau to perform a behaviour because they perceive that doing so will benefit the whānau collectively. In the current research this manifested as a motivation to comply with the perceived behavioural expectations of referents (Ajzen et al., 2018). In the RAA (Technology) model, perceived norms have a direct impact on behavioural intentions; in the current research, understanding normative beliefs has led to the design of an application that is grounded in Kaupapa Māori.

The current research contributes to gamification theory by explaining the factors that significantly impact the adoption of gamified mHealth applications for Māori. Previous research has noted that persuasive strategies such as competition are commonly designed into health behaviour change applications (Orji et al., 2014); however, there was a gap in knowledge about which persuasive strategies are effective and appropriate for Māori. The current research showed that some Māori identity is linked to a collectivist culture, and participants perceive that applications designed to encourage users to work together in socially connected groups (Mahi Tahi – cooperation) may be more effective for Māori, it is the use of competitive strategies (Whakataetae – competition) that potentially drives individual's intentions to use the *Hīkoi to Health* application. This finding clarifies which socially-oriented persuasive strategies would be most effective. Similarly, this study contributes to knowledge by showing that the most important factors to determining expected application usage by Māori individuals are Māori-centric design, Perceived Ease of Use, and Whakataetae (competition), and that there is a significant relationship between Māori-centric design and Perceived Ease of Use which signifies that the design protocols of the intervention must align with the cultural practices and aspirations of the target audience.

The current research contributes to a growing body of knowledge on the co-design of health behaviour change applications for Indigenous populations. This kaupapa has followed tikanga Māori (customary protocols); it has embraced Te Reo Māori (Māori language); and it has fostered Māori inclusiveness in designing interventions that support aspirational behaviour change for Māori. The right of all people to tino rangatiratanga (self-determination) has been a key driver in the design of the current research, as it is fundamental to a Kaupapa Māori approach, and should be a critical aspect of any research undertaken within Indigenous and minority populations (Barnes, 2000; Came-Friar et al.,

2019). In the design of the current research, no assumptions were made about the participants' abilities to speak Te Reo Māori, and therefore, hui data were gathered in the participant's language. This gave participants the ability to speak freely and find the words that best described their ideas. The current research adapted a participatory co-design framework to identify and understand issues and aspirations of Māori before attempting to develop a solution to meet their needs. The process was iterative and participants and stakeholders were included in the prototype design providing feedback before releasing the prototype to a broader Māori audience for evaluation. An iterative and inclusive process is critical as it ensures that the final artefact reflects the voices and visions of participants (Eyles et al., 2016; Harding et al., 2021).

10.3 PRACTICAL IMPLICATIONS

The current research makes two contributions to knowledge for practitioners: It has shown that a co-design framework that inclusively seeks the voices of affected communities to understand their unique social context, issues, and aspirations is an effective method of intervention development; and, it has shown that the operationalisation of game design elements begins by determining which persuasive strategies are most appropriate for the specific community.

10.3.1 PERSUASIVE STRATEGY DECISIONS FOR PRACTITIONERS

The current research makes two contributions to knowledge for practitioners: It has found that intervention development should use a co-design framework that inclusively seeks the voices of affected communities to understand their unique social context, issues and aspirations (Ni Mhurchu et al., 2019; Te Morenga et al., 2018); and, it has found that the operationalisation of game design elements begins by determining which persuasive strategies are most appropriate for the specific community (Khaled, 2008). The current research found that some Māori have a strong sense of collectivism, and therefore, participants perceived that cooperative strategies would be the most effective. However, the current research also found that competitive strategies are the key foundational strategy for the adoption of gamified technologies, and therefore, in a Māori health context, Mahi Tahi (cooperation) and Whakataetae (competition) are both crucial. This finding may translate differently within different Indigenous contexts, and therefore it is important that prototypes are co-designed and evaluated within the affected community.

10.3.2 GAME DESIGN ELEMENT OPERATIONALISATION

Game design elements are the building blocks of gamification and are selected and configured differently to support each persuasive strategy. The design decisions relating to health behaviour change intervention gamification differ depending on the overarching persuasive strategy selected. For example, persuasive strategies such as Mahi Tahi (cooperation) and Whakataetae (competition) might use different combinations of the same game design elements.

A previous criticism of gamification literature is that it lacks a standardised approach to operationalisation (Deterding, 2015; Deterding et al., 2011). The current research has presented a design architecture plan (see Figure 7.2) which shows that wero (quest) ideas generated by participants during the co-deign hui can be adapted for different persuasive strategies. Suggestions for appropriate matching game mechanic combinations to support the strategies were also presented (Table 7.2). Exemplar Tables 7.3; 7.4; 7.5; and 7.6 show game design element implementation suggestions for both cooperative and competitive strategies for each of the four different target behaviours. These artefacts give designers a framework for making design decisions that will be appropriate in different contexts.

10.4 LIMITATIONS AND FUTURE RESEARCH

The current research explores how gamification can be used to support positive health behaviour change in a Māori context, and therefore, there are some limitations that might constrain the generalisability of the findings. Participants were recruited via publicly accessible means such as posters, Facebook posts, and a website. This may have introduced some self-selection bias in both Phase One and Phase Two. However, this issue was mitigated in Phase Two where the sample size is 377, and confidence levels indicate that the likelihood that the mean for any variable calculated from the sample is representative of the whole population with a 95% probability.

Previous Māori health research has recruited participants from within clearly defined social communities. The current research invited anyone who identifies as Māori to participate; therefore, participants may not be highly interconnected in the real world. The development of the non-interactive *Hīkoi to Health* prototype into an interactive test-version would allow the relationship between real-world Social Connection and persuasive strategy preference to be tested.

The current research explored participants perceptions and beliefs about the *Hīkoi to Health* prototype and not actual behaviour; it has identified which factors theoretically

predict expected application usage. The *Hīkoi to Health* prototype does not measure increased physical activity, nor improved nutrition, both of which might be target behaviours in an actual application. A test version of the *Hīkoi to Health* application would allow researchers to investigate the effectiveness of the application to support positive health behaviour change, and to determine how effectively it supports users to perform actual behaviours.

The purpose of this PhD journey has been for an inexperienced researcher to learn, under supervision, the necessary skills required to conduct future research independently. This journey has been extremely challenging and at times it has been overwhelming. This research has been conducted through the theoretical lens of the Reasoned Action Approach, and from the perspective of a Kaupapa Māori, or a Māori world view. Many different research design decisions could have been made and it is acknowledged that a different theoretical framework such as the use of the Technology Acceptance Model would also have been appropriate.

10.5 CHAPTER SUMMARY

The main aim of this study has been to investigate how to leverage gamification in the design of mHealth applications that specifically support positive health aspirations of Māori. The current study has shown that while gamification has been integrated into health and fitness applications more frequently in recent years, the practical applications are not well understood, particularly in relation to Indigenous and minority populations. The process followed in Phase One was participatory; three co-design hui were conducted to explore how participants perceived various persuasive strategies, to determine which they perceived would support Māori to become more active and to make healthier food choices. The hui also elicited specific ideas about designing an intervention including various wero (quests) and combinations of game design elements to support each quest idea. This study has shown that co-design is critical in Indigenous and minority populations to ensure the voices of impacted people are central to the design solutions. By following Kaupapa Māori (Māori principles and ideas) and tikanga (cultural protocols), the health aspirations of Māori are more clearly understood and any proposed design solution is more culturally appropriate.

The aims of Phase Two were to determine which persuasive strategies are most effective for Māori; to evaluate the implementation of game design elements into the design; and to determine if the prototype is culturally appropriate and which features

might predict its usage. The main outcome of Phase One was a non-interactive prototype of an mHealth application to support positive health behaviours for Māori. This prototype was called *Hīkoi to Health*, a name suggested by a Māori health advisor during preliminary discussions. Phase Two took the resultant artefact and evaluated it using criteria identified in Phase One and in extant literature. The results of Phase Two showed that a wider Māori audience agreed that the prototype resonated with Māori, and that respondents indicated that they would try the application when it became available. In the current research, the overarching research question was: *How can gamification be used in Māori mHealth applications?* This question has been answered by exploring three dimensions: key contextual elements that shape Māori health; effective persuasive strategies; and, combinations of game design elements to support specific persuasive strategies.

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APPENDICES

12.1 APPENDIX A – BRIEF HISTORY OF AOTEAROA

The founding of Aotearoa, New Zealand, dates back to the 13th century when it was discovered and settled by Polynesians from Eastern Polynesia (Wilmshurst et al., 2011). These early Māori settlers had brought traditional ahuwhenua (farming) crops such as kūmara (sweet potato), taro, hue (a type of gourd) and uwhi (yams). Besides these introduced crops, the pre-European diet consisted of aruhe (fern roots), birds, and seafood (Kingi, 2008). Māori regard natural resources such as land, water, plants, fish, birds, and animals, as taonga (treasures), and the concept of kaitiakitanga (guardianship) is essentially one of governance as it considers the relationship between people and nature from the perspective of resource preservation and management for Māori communities (Royal, 2007).

Mana whenua (people with customary authority over land) is the notion that different iwi (tribes) and hapū (subtribes) have different customary rights over land, and sometimes different rights over the same land. The concept of mana whenua is complex, hapū (sub-tribes) and whānau (extended family groups) could have customary rights to use the same land for different purposes such as fishing or cultivation (McAloon, 1999). Mana whenua is entirely different from the European concept of land ownership, in that some Māori are the kaitiaki, or guardians and protectors of the land (Wilmshurst et al., 2011), and the notion of absolute ownership of land was rare (McAloon, 1999).

Colonisation, as practised by early 18th-century Europeans, was centred around trade, resources, and migration. The primary aim of early colonists was to settle in Aotearoa, not to rule over Indigenous people (Young, 2015). By the late 1830s, increasing numbers of British and European migrants flocked to New Zealand on the promise of land ownership (King, 2003). These migrant Europeans considered land utilisation was the determinant of ownership (Young, 2015). Therefore, Māori were not deemed land *owners* from the European perspective as Māori were simply occupiers and guardians of land; thus, illustrating the marked differences between Māori and European settlers. Yet, pre-European Māori *were* cultivators, and unlike many other nomadic Indigenous peoples, had a strong claim to territorial sovereignty. Māori did not establish large-scale agricultural practices until after the arrival of European settlers, but evidence of pre-European cultivation is noted throughout history (King, 2003). The Crown-sanctioned practice was to move the Indigenous people off ancestral lands, either by force or by extermination.

This loss of access to ancestral lands and to traditional food sources has resulted in inter-generational poverty that still impacts Māori people today (Theodore et al., 2015).

12.1.1 Colonisation and the Treaty of Waitangi

In the 1830s, Aotearoa New Zealand was an independent nation and not yet subject to British law; Britain had established a penal colony in New South Wales and considered New Zealand to be an outpost of this (King, 2003). With an ever-increasing number of European and British settlers, there was growing lawlessness in New Zealand, evidenced by reports of unruly behaviour by some European settlers (Ross, 1887). There was an increasingly large number of disadvantageous land transactions with Māori, and indications of a potential French invasion (Tremewan, 2010) which compelled the British government to take action. The British government determined that the act of annexing New Zealand could protect Māori from fraudulent land transactions, and to enforce sovereign rule over British subjects. Additionally, annexing New Zealand would secure commercial interests for the British Crown (King, 2003).

Increasingly, altercations between Māori and European led to legal disputes and several Māori tribes requested intervention by the Crown to settle the disagreements. As a solution, the British government appointed James Busby as Permanent Resident, a largely consular role to represent the British commercial interests and to mediate between settlers and Māori (Orange, 2015). As a civilian, Busby lacked military backing, and therefore, had little actual authority in his role. By the late 1830s, New South Wales land speculators were pressuring northern Māori to sell land (Orange, 2015). This was a significant issue as Māori traditionally do not recognise land ownership in the same way as Europeans. Tribal leaders raised concerns about individuals selling ancestral tribal land, as traditionally, Māori land does not belong to an individual.

Busby was instructed to convince Māori to agree to a convention of peace, trade and justice; he believed that a sovereignty agreement between Māori chiefs was the answer, and he prepared the *Declaration of Independence* which asserted Māori sovereignty over New Zealand. Busby successfully negotiated with 34 northern chiefs to sign the declaration. Some Māori felt that signing the declaration enhanced their mana (status) and personal relationship with the British King, whilst others were suspicious of the process. Busby hoped that an annual congress of chiefs at Waitangi could establish a government of sorts for the determination of justice, peace, and trade (Orange, 2015). The declaration was recognised by the British Colonial Office, with the added assurance that the King would offer protection to Māori provided it was the interests of His Majesty's subjects. Busby

continued to collect signatures for the declaration until 1839, although it is noted that most of the signatories were from the northern tribes with only a few from southern iwi.

In 1938, Europeans with a vested interest (such as missionaries, settlers, and merchants) proclaimed that British intervention in New Zealand was necessary, and therefore pressured the Crown to establish a formal colony and an effective government in New Zealand. However, opinions differed as to the extent of the intervention, and the role that some Māori would play in the nation's future. This era marked a significant negative shift in British attitudes toward New Zealand as the inevitability of British colonisation became accepted. Many Māori inadvertently contributed to the negative perceptions by conveying an eagerness for British law, and by appearing to submit to the wholesale sale of land to speculators.

During the rest of the decade, the sovereign status of New Zealand was repeatedly eroded with the appointment of Hobson, whose purpose was to strengthen British interests and gain jurisdiction over several districts before establishing New Zealand as a Crown colony. Hobson noted that the Māori population was declining quickly and that it was imperative to act quickly to secure New Zealand for Britain. At the time, colonists' schemes were underway to profit from land sales. News that Hobson had been charged with negotiating an accord with Māori and examining land titles to protect Māori interests was not popular with the *New Zealand Company*, a commercial trading entity making profits by acquiring Māori land cheaply and then on-selling it at high profits for its shareholders.

An attitude of British dominance and Māori oppression underpins the racism and persistent breach of Māori rights that still dominates the State's relationship with Māori today (Cormack et al., 2020). The *Colonial Office* was charged with the growth and administration of the interests of the British Empire in New Zealand. Initially, the *Colonial Office* stated that it sought to acquire cessation of only part of New Zealand in order to establish a Crown colony and jurisdiction over British subjects. It also stated that complete annexation was an unnecessary invasion of Māori rights that would likely bring unnecessary costs and responsibility to the Crown. However, the possibility of allowing Māori to govern alone was rejected as unworkable and ineffective as Europeans determined there was no consensus of agreement between Māori, and that the societal structure of iwi, hapū and marae were inherently dispersed and volatile (Orange, 2015).

Hobson was given discretion to negotiate with Māori for the "whole, or any parts of New Zealand that Māori wished to cede" (Orange, 2015, p. 32). The instructions given to Hobson included some provisions for Māori welfare; Māori interests in land negotiations

were to be protected; schools and missions were to be established; and Māori customs were to be tolerated until the *savages* could be civilised (Orange, 2015). Official recognition of the *Declaration of Independence* meant that the rights of Māori were acknowledged, and the Crown was unable to simply annex New Zealand unless the consent of Māori had been obtained. Theoretically, a treaty signed by Crown representatives would acknowledge and confirm the rights of the Indigenous people and promise Māori the status of British subjects. Hobson was expected to present the treaty to Māori in such a way that the Crown could proceed with peaceful colonisation. The transfer of authority to the Crown was downplayed to gain Māori agreement, and Māori opposition to the treaty was calmed by promises of Māori independence under British sovereignty and treaty opponents were told their agreement was necessary to establish law and order in an effort to control Europeans (Orange, 2015).

Hobson arrived in New Zealand via Sydney where he had peremptorily been sworn as Lieutenant Governor of any future territory that Māori might cede (King, 2003). In addition, a proclamation stating that any land transfers between Māori and European would be investigated and validated by the Crown representatives; effectively halting future sales (Orange, 2015).

The English and Māori versions of Hobson's treaty significantly differ in meaning, particularly about the meaning of having, and ceding sovereignty. The English version stated that Māori gave the Crown "all the rights and powers of sovereignty", whereas the Māori version stated that chiefs gave the Crown te kawanatanga katoa (governance over the land) a concept of dual authority (*Treaty of Waitangi*, 1840, art. 1). The Māori version also confirmed and guaranteed te tino rangatiratanga, (the right to chieftainship and autonomy over lands, villages) and taonga katoa (treasured things). Māori agreed to allow the Crown the right to negotiate with them over land transactions. However, the English version confirmed and guaranteed the "exclusive and undisturbed possession of their lands and estates, forests, fisheries, and other properties". Additionally, the Crown requested the *exclusive* rights to negotiate with Māori in land transactions (*Treaty of Waitangi*, 1840, art. 2). Article Three, in which the Crown gave the assurance that Māori would have the same rights and protection as British subjects is considered a precise translation of the English text (*Treaty of Waitangi*, 1840, art. 3).

At Waitangi, the Treaty was presented to Māori as a necessary tool to allow control over lawless Europeans, and it promised to protect Māori from future foreign invaders; proponents also declared the Treaty was a sign of high regard for the Māori people by the

British monarch. Māori were promised rangatiratanga – to maintain chieftainship and authority over their lands and people. In the Māori version there was no mention that by signing the Treaty, Māori were ceding sovereignty to Britain. Furthermore, addressing the rangatira (chiefs and leaders) at Waitangi, Busby assured Māori that Governor Hobson would secure them possession of the land that was not yet sold, and in some cases, would return land that had been unjustly sold (Orange, 2015). As previously stated, the governance of land is an important concept in Māori culture, as land is taonga (precious) and kaitiakitanga (guardianship) of land increases the mana (status) of the people. It is clear from historical records that the British representatives present at Waitangi and those who subsequently travelled the country obtaining Māori signatories, intentionally misled Māori about the implications of signing such a treaty.

In the aftermath of the signing, concerned missionaries attempted to hold the government to account by demanding the Crown honour the *spirit* of Te Tiriti (the Treaty). When the ambiguity and inconsistency between the English and Māori versions of the Treaty was challenged, this *spirit* would "sustain a sense of Māori expectation and Pākehā obligation that treaty promises should be kept" (Orange, 2015, p. 58). It is essential to acknowledge that many Māori rangatira (chiefs) refused to sign the Treaty. However, the document asserted authority over all Māori, not only those who had signed it.

In the 1850s the Kingitanga movement (King movement) arose in the central North Island, its purpose was to establish a Māori role like that of the British monarch to halt the deceitful methods of Pākehā (European) land acquisition. The colonial government considered the Kingitanga movement was a challenge to the sovereignty of the British monarchy, and the colonial government's reaction was to send military forces into the Waikato region to reclaim power and to crush the movement. Hostilities lasted nine months and were the bloodiest and most significant of the New Zealand Wars. Many Māori felt that the hostilities demonstrated that the colonial government had not upheld their rights under the Treaty, and signifying that it provided Māori with inadequate protection. The colonial government defeated the Kingitanga tribes and confiscated around 12,000 km^2 of land throughout the greater Waikato region. This loss of land was devastating to the livelihood of the Māori people, and led to immense poverty and loss of mana, the bitterness of the loss of land would sustain Māori anger for another century until the establishment of the *Waitangi Tribunal* in 1975 sought to address Māori grievances.

Since the signing of Te Tiriti (the Treaty), Māori have been disadvantaged as a consequence recurring treaty breaches that advance the aims of Pākehā (the European

majority) and minimise Indigenous control and sovereignty (Theodore et al., 2015). In more modern times, the *Treaty of Waitangi Act 1975* (and subsequent amendments) provides for the "practical application of the principles of the Treaty and for that purpose, to determine its meaning and effect whether certain matters are inconsistent with those principles" (*Treaty of Waitangi Act 1975*). One of the essential principles of the Treaty is the principle of tino rangatiratanga (self-determination and sovereignty), and yet, subsequent governments have failed to honour this aspect of the Treaty.

12.2 APPENDIX B – PARTICIPANT INFORMATION SHEET

Participant Information Sheet – Co-Design Hui

Waikato Management School
Te Raupapa

THE UNIVERSITY OF WAIKATO
Te Whare Wānanga o Waikato

This research project has been approved by the Human Research Ethics Committee (Health) of the University of Waikato under UoW HREC(Health) 2018#75.

Any questions about the ethical conduct of this research may be addressed to the Secretary of the Committee, email humanethics@waikato.ac.nz, postal address: University of Waikato, Te Whare Wananga o Waikato, Private Bag 3105, Hamilton 3240.

Research Project Title:

Using gamification to support positive health behaviour changes

Invitation:

You are being invited to take part in this research project. Before you decide to do so, it is important you understand why the research is being done and what it will involve. Please take time to read the following information carefully and discuss it with others if you wish. Ask us if there is anything that is not clear or if you would like more information. Take time to decide whether you wish to take part. Thank you for reading this.

Project Purpose:

This research project aims to investigate how technology can be used to support people to make positive health behaviour changes. It specifically looks at the impact of computer-game design elements on health improvement outcomes. This preliminary study will be useful to guide the development of a smartphone application for use in low-risk, non-medical intervention trials.

Why have I been chosen?

Participants in this study must be adults aged 18-65, and must be of Māori descent. Finding ways to encourage Māori to be more active and make healthy food choices is an important part of this study.

This study follows Kaupapa Māori principles, it recognises the importance of working together to find solutions to problems which face many New Zealanders. You have been chosen

because you are the expert of your own experiences with smartphone technology, and therefore have great knowledge which may be used to help the wider community.

Do I have to take part?

It is up to you to decide whether to take part. If you do decide to take part you will be able to keep a copy of this information sheet and you should indicate your agreement on the consent form. You can withdraw at any time before three weeks after your Co-Design Hui. You do not have to give a reason.

What will happen to me if I take part?

You will be asked to participate in a small group workshop, which will include discussions and some activities. It is expected the Hui will take approximately 60-90 minutes. You will be asked at the start of the workshop for your consent to participate, and for the findings to be published.

What type of information will you ask me about?

The researcher will ask you about your opinions and experiences related to smartphone applications, in particular, health-related apps. In addition, you will be asked to participate in some activities and discussions which will help identify the ideal features a smartphone application should include. You do not need to have any technical skills, or to be particularly creative.

What are the possible disadvantages and risks of taking part?

Participating in the research is not anticipated to cause you any disadvantages or discomfort. The potential physical and/or psychological harm or distress will be the same as any experienced in everyday life

What are the possible benefits of taking part?

Whilst there are no immediate benefits for those people participating in the project, it is hoped that this work will have a beneficial impact on health outcomes for many New Zealanders.

What if something goes wrong?

If you have any complaints about the project in the first instance you can contact any member of the research team. If you feel your complaint has not been handled to your satisfaction you can contact the Secretary of the *University of Waikato Human Research Ethics Committee (Health)* humanethics@waikato.ac.nz to take your complaint further.

Will my taking part in this project be kept confidential?

All information collected about you will be kept strictly confidential. These workshops will be digitally recorded, and photographs of activities will be taken. Faces of participants will be blurred on the photographs to ensure anonymity. Discussions will be electronically recorded and later will be transcribed and identifying information will be removed from the transcript.

Confidentiality is assured, no person besides the researcher and supervisors will be able to identify individual respondents. Original recordings will be deleted following the research process.

What will happen to the results of the research project?

Direct quotations and summarised findings may be included in a doctoral thesis and additionally in articles, lectures, and other presentations. Your personal details will remain confidential and you will not be identifiable from the published findings.

This co-design Hui will be used by a University of Waikato doctoral student for the purposes of completing a thesis. A final copy of the thesis will be submitted to the University of Waikato Research Commons and will be available for academic purposes. It may also be used for subsequent journal articles and presentations.

Who is organising the research?

The research will be undertaken by Dannie Jefferies, a University of Waikato doctoral student.

Who has ethically reviewed the project?

This preliminary stage of the project has been ethically approved by *the University of Waikato Human Research Ethics Committee (Health)*.

How can I withdraw from this project?

You can leave the Hui at any time if you no longer wish to participate. If you wish to withdraw fully from the project you may do so at any time in the three-week period after your co-design Hui. If you choose to withdraw from the research you may do so by emailing the researcher dannie.jefferies@waikato.ac.nz. The researchers will make every effort to remove your comments from the transcript of the Hui, although it is difficult at times to identify individual voices in a group conversation and so it is possible that some of your thoughts may be unintentionally included in the research even if you withdraw.

Contacts for further information:

Researcher:

Dannie Jefferies dannie.jefferies@waikato.ac.nz Phone 07 837 9241

Supervisors:

Stuart Dillon stuart.dillon@waikato.ac.nz Phone 07 838 4234

Karyn Rastrick karyn.rastrick@waikato.ac.nz Phone 07 838 4207

John Oetzel john.oetzel@waikato.ac.nz Phone 07 838 4431

12.3 APPENDIX C – PARTICIPANT CONSENT FORM

Participant Consent Form – Co-Design Hui

Waikato Management School
Te Raupapa

THE UNIVERSITY OF WAIKATO
Te Whare Wānanga o Waikato

Using gamification to facilitate positive health behaviour change

I have read the information sheet for participants for this study and have had the details of the study explained to me. My questions about the study have been answered to my satisfaction, and I understand that I may ask further questions at any time.

I also understand that I am free to withdraw from the study, or to decline to answer any particular questions in the study. I agree to provide information to the researchers under the conditions of confidentiality set out on the information sheet.

I also understand that if I wish to withdraw from this study I may do so any time in the three-week period following my Co-Design Hui by emailing the researcher dannie.jefferies@waikato.ac.nz, in which case any data collected including the discussion recording and transcript will be destroyed.

I agree to participate in this study under the conditions set out in the information sheet form.

PARTICIPANT

Signed: _____ Date: _____

Name: _____

RESEARCHER

Signed: _____ Date: _____

Name: _____

The research will be undertaken by:

Researcher:

Dannie Jefferies	dannie.jefferies@waikato.ac.nz	Phone 07 837 9241

Supervisors:

Stuart Dillon	stuart.dillon@waikato.ac.nz	Phone 07 838 4234
Karyn Rastrick	karyn.rastrick@waikato.ac.nz	Phone 07 838 4207
John Oetzel	john.oetzel@waikato.ac.nz	Phone 07 838 4431

12.4 APPENDIX D – PARTICIPANT DEMOGRAPHIC FORM

Participant Demographic Information – Co-Design

Waikato Management School
Te Raupapa

THE UNIVERSITY OF WAIKATO
Te Whare Wānanga o Waikato

Using gamification to facilitate positive health behaviour change

Hui Date: _____ Hui Location: _____

Name: _____

This study requires that participants are between the ages of 18 and 65, and are of Māori descent.

Do you identify as New Zealand Māori? ☐ Yes ☐ No

Which Iwi do you belong to? _____

The following details are collected for statistical purposes only. You may choose not to complete this section:

Please identify which age group you belong in:

☐ 18-24 ☐ 25-34 ☐ 35-44 ☐ 45-54 ☐ 55-64 ☐ 65+

Which gender do you identify with? ☐ Male ☐ Female ☐ Non-Binary

If you wish to be invited to take part in a future 12-week trial of a health technology, please supply your email address. An invitation to take part in a later study does not mean you have agreed to accept the invitation.

Email address: _____

Researcher Use Only: *Participant ID Code* _____

☐ *Consent Received*

☐ *Participant Information Sheet given*

12.5 APPENDIX E – ETHICAL APPROVAL

The University of Waikato
Private Bag 3105
Gate 1, Knighton Road
Hamilton, New Zealand

Human Research Ethics Committee
Karsten Zegwaard
Telephone: +64 7 838 4892
Email:humanethics@waikato.ac.nz

THE UNIVERSITY OF
WAIKATO
Te Whare Wānanga o Waikato

14-12-18

Dannie Jefferies
dlj1@students.waikato.ac.nz

Dear Dannie

UoW HREC(Health) 2018#75 : Using gamification to facilitate positive health behaviour change (Phase One (Part B))

Thank you for submitting your amended application HREC(Health) 2018#75 for ethical approval.

We are now pleased to provide formal approval for your project within the parameters outlined within your application.

If you need to make any changes to the elements approved within the application that requires ethical approval, please contact with committee (humanethics@waikato.ac.nz), quoting the approval number, and seek an amendment to your application. Any minor changes or additions to the approved research activities can be handled outside the monthly application cycle.

We wish you all the best with your research.

Regards,

Karsten Zegwaard PhD
Acting Chairperson
University of Waikato Human Research Ethics Committee

12.6 APPENDIX F – DESIGN OF CARD ARTEFACTS

PERSUASIVE STRATEGIES CARDS

The design of the persuasive strategies cards as shown in *Figure 12.1 Persuasive strategies card* is symbolic, and each of the design components: colour, title, descriptor, kōwhaiwhai (decoration), and card type, has significance.

Colour

The colours used for the cards are culturally significant: In Māori mythology whero (red) represents Papatūānuku (Earth Mother) and te whaiao (the origins of life). Mangu (black) symbolises Rangi-nui (Sky Father, and husband of Papatūānuku), traditionally, mangu is a metaphor for the eternal darkness from which the earth emerged. Mā (white) symbolises te ao mārama (the physical world). In Māori mythology te ao mārama was created when Papatūānuku and Rangi-nui were pushed apart by their children, thus creating the rivers, oceans, land, forests and animals on earth (Kaai-Oldman, 2004; Rangiwai, 2018).

Figure 12.1

Persuasive strategies card design

Card Title

As discussed in *Chapter 2.6,* ten persuasive strategies were identified from the literature, using these concepts, ten distinct cards were developed. The title of each card represents the persuasive strategy concept, the title text is shown in two languages, Te Reo Māori followed by English. Taonga tuku iho (the principle of cultural aspiration) asserts the significance and authenticity of Te Reo in Māori research (Smith, 1990) and therefore, placing Te Reo before English signals that the English text is less important. As the researcher is not fluent in Te Reo the titles were translated from English. Translations were made using the online Māori Dictionary, and verified by two fluent Te Reo speakers.

Descriptor

The persuasive strategies concepts have been described in plain language to ensure that they can be easily understood by participants who do not have an academic background. It was intended that the conceptual cards should be self-explanatory and not require the researcher to explain them in-depth.

Although this study recognises the importance of Te Reo as taonga, it would be inconsiderate to assume that all study participants were fluent, and therefore the descriptors are presented in English.

Kōwhaiwhai

The cards all feature a traditional kōwhaiwhai (decoration), the icon chosen is the mangōpare (hammerhead shark) symbolises "strength and the application of knowledge" (Purdie et al., 2015, p. 2). The mangōpare illustration was sourced from Nilson (2010), however it also appears in many free clipart resources such as clipart.com. Mangōpare is a powerful metaphor, Smith et al. (2015, p. 153) explain that mangōpare "operate alone but they also come together as a collective when the need arises, nurturing their young and protecting their boundaries, behaving in many respects, like whānau, hapū and iwi collectives".

Card Type

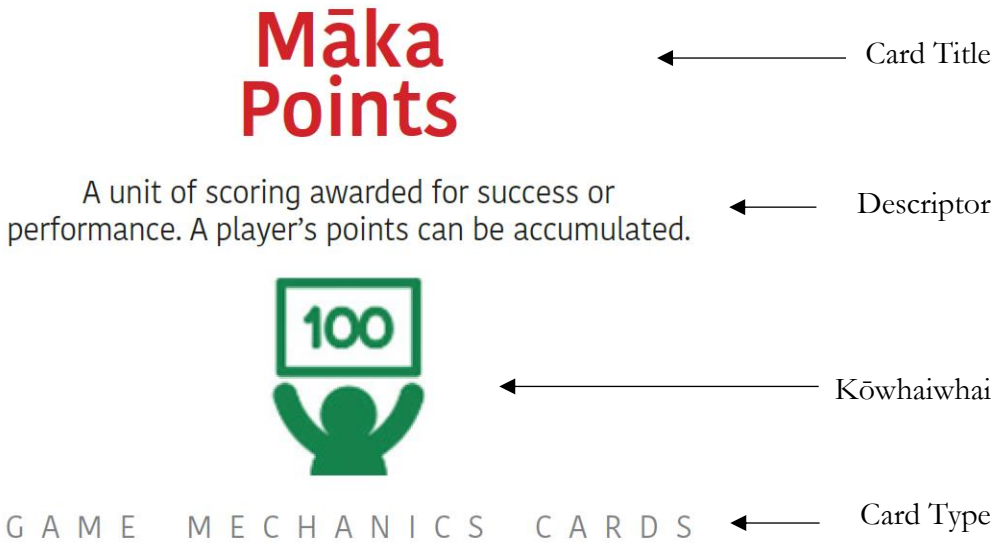
The card type label simply illustrates to which card deck an individual card belongs.

GAME MECHANICS CARDS

The design concepts for the game mechanics cards, as illustrated in *Figure 12.2 Game mechanics cards* are the same as the persuasive strategy cards except for the kōwhaiwhai (decoration). In the game mechanics cards the mangōpare has been replaced by ten individual graphical representations of the card concepts. These have been obtained from various royalty free sources such as shutterstock.com and pngguru.com. Sources for each of the illustrations used can be found on Table 12.1.

Figure 12.2

Game mechanics cards



SOURCES OF GRAPHICS USED IN GAME MECHANICS CARDS

Table 12.1

Sources of graphics used in game mechanics cards

Image	Card	Sourced from:
	Māka Points	https://www.shutterstock.com/image-vector/score-icons-491910988
	Tohu Badges	https://www.clipartwiki.com/iclipmax/Tmbmm
	Papa Tātai Leaderships	https://www.pngguru.com/free-transparent-background-png-clipart-nizvh
	Whakatauranga Ratings	Adapted from: https://www.pngguru.com/free-transparent-background-png-clipart-nzghd
	Whakatangata Avatars	Adapted from https://www.cleanpng.com/png-computer-icons-font-awesome-user-font-2126937
	Kōeke Levels	Researchers own graphic
	Wero Challenges/Quests	Adapted from https://www.shutterstock.com/image-vector/two-mountain-peaks-snow-flat-vector-593783084
	Whakatutukitanga Achievements	https://www.freeiconspng.com/img/13762
	Kohikohinga Collection	https://www.shutterstock.com/image-vector/collecting-icon-symbol-design-activity-hobbies-1206662203
	Pakiwaitara Narrative Context	https://www.iconsdb.com/black-icons/book-icon.html

12.7 APPENDIX G – HUI PROCESS AND EXAMPLE QUESTIONS

Hui Agenda

- Karakia
- Introductions / Ice Breaker (15-MINUTES)
- Discuss issues (30-MINUTES)
- Design idea generation (45-60-MINUTES)
- Closing Karakia and wrapping up (15-30 MINUTES)

Karakia – Meeting Opening

Whakataka te hau ki te uru,	Get ready for the westerly
Whakataka te hau ki te tonga.	and be prepared for the southerly.
Kia mākinakina ki uta,	It will be icy cold inland
Kia mātaratara ki tai.	and icy cold on the shore.
E hī ake ana te atākura he tio,	May the dawn rise red-tipped on ice,
he huka, he hauhunga.	on snow, on frost.
Haumi e! Hui e! Tāiki e!	Join! Gather! Intertwine!

Introduction

Nau mai haere mai kia koutou katoa.	*Greetings to one and all*
Ko Taikorea toku maunga	*Taikorea is my mountain*
Ko Rangitikei toku awa	*Rangitikei is my river*
Ko ngati Apa toku iwi	*Ngati Apa is my tribe*
Ko Kurahaupō toku waka	*Kurahaupo is my canoe*
Ko Dannie ahau	*My name is Dannie*

E mahi ana ahau ki Te Whare Wananga o Waikato, Te Kura Raupapa i roto i Te Kura o Te Whakahaere me to Tairanga.

I work at the Waikato Management School in the School of Marketing and Management

No reira, tēnā koutou, tēnā koutou, tēnā tatou katoa

Therefore, greetings, greetings, greetings to you all

Icebreaker (15 Minutes)

- Invite participants to introduce themselves in English or Te Reo
- Aim of the session
- Consent Forms: Video/Audio recording, (voice + photographs, participant's faces will be obscured)
- Answer questions of participants

Kai Karakia (Grace)

Whakapaingia ēnei kai	*Bless our Food*
Hei oranga mo ō mātou tinana	*As well being for our body*
Whāngaia ō mātou wairua	*Feed our spirit*
Ki te taro o te ora	*With the food of wellness*
Ko Ihu Karaiti tō mātou kaiwhakaora	*For Jesus Christ our Healer*
Āmine	*Amen*

Kai Mahi – Sharing Food and Working

Discuss Issues (20-30 Minutes)

Understand how participants use their devices. Guiding questions:

- Tell me about how you use your devices
- Which apps do you use the most?
- How do you connect to the internet? E.g.:
    - Wi-Fi at home
    - Data plan
    - Use free Wi-Fi hotspots

Understand how participants perceive technology. Guiding questions:

- How do you think technology can be used to encourage you to be more active or to eat healthily?
- What does eating in a healthy way look like to you?
- How do you think your phone could be used to encourage you to be more active?
- How do you feel about using your phone for motivation?
- Do you think there are any issues around using your phone for motivation?

Design Idea Generation 45-60 Minutes

Activity: Persuasive Technologies and Strategies

Set of 10 cards, each containing a different persuasive strategy (See Figure 5.2

- (5-10 minutes) Rank how you believe each of these concepts would **personally motivate you**. #1 is most motivating, #10 being least motivating
- (10-15 minutes) In groups of 2-3 identify 3-4 strategies which you believe would be the most persuasive. Compare your rankings with others in your group, can you come up with an agreed list of the 3-4 most persuasive strategies

Activity: Game Mechanics

Set of 10 cards, each containing a different game-design element (See cards: Figure 5.3))

- (10 minutes) Using the 3-4 most persuasive strategies your group agreed to previously, take the game mechanics cards, and combine various game mechanics with each of your persuasive strategies. A game element can be used in multiple, or none of the persuasive strategies.

Discussion:

- (10 minutes) A spokesperson for each group reports back to the whole meeting; briefly explain how you have linked the game mechanics and persuasive strategies.
- To what extent do we agree, and why?
- Note differences, this could be interesting data
- Can we come up with a consensus for the whole group?

Gamification Design Brainstorming Session:

(20+ minutes) With each of the agreed motivation and mechanics combinations determined in the previous step, the group will brainstorm different ways in which these combinations could be used in a smartphone application.

Wrapping Up Karakia

- Thank participants for their contribution
- Remind them they can withdraw within three weeks of the hui and can email the researcher to do this.

Unuhia, unuhia	*Draw on, draw on,*
Unuhia ki te uru tapu nui	*Draw on the supreme sacredness*
Kia wātea, kia māmā, te ngākau, te tinana,	*To clear, to free the heart,*
te wairua i te ara takatā	*the body and the spirit of mankind*
Koia rā e Rongo, whakairia ake ki runga	*Rongo suspended high in heaven*
Kia wātea, kia wātea, ae rā! Kua wātea.	*To clear, to clear, yes, it's clear!*
Rire, Rire, Hau.	*Peace to us all!*
Pai mārire!	

Resources Required:

- Participant information sheets
- Participant Consent forms
- A set of persuasive strategies cards for each participant
- A set of game mechanics cards for each participant
- Post it notes
- Large A2 sheets of paper
- Marker pens in different colours
- Name Cards
- Pens

12.8 APPENDIX H – SURVEY INSTRUMENT

Qualifier Questions

Do you identify as Maori?

→ Yes → *which iwi do you belong to?* → *Proceed to verify age*
→ No → *keep answers, but do not analyse*

Are you over 18?

→ Yes → *Proceed to Q1*
→ No → *ineligible* → *proceed to thank you screen*

Instructions

Questions in this section will help fine-tune a new healthy living smartphone app called *Hīkoi to Health*. This app is being designed by Māori, for Māori. Your answers in this survey will help the designers understand what is important to you individually, and what you think is important for Māori collectively.

In this section you will see some illustrations that show some pages from a new app. The illustrations, goals, quests and rewards are based on ideas generated in several design hui. The application is designed to encourage people to become more physically active, and to make healthier food choices. Once you have looked at these illustrations, you will be asked to answer a few questions about your preferences, and about the app in general. Are you ready to begin?

In this section, please read the following statements and indicate how strongly you agree or disagree with each statement. 1 = strongly disagree, and 5 = strongly agree

Scale Items

Q1 Is there a preference for cooperative (MT) persuasive strategies?

- Q1a I would prefer to take an outdoor walk with a friend rather than by myself.
- Q1b I would try harder to be more active if I was helping my whānau to be more active
- Q1c Seeing our group's combined performance would keep me motivated
- Q1d I prefer physical activities that include other people

Q2 Is there a preference for competitive (W) persuasive strategies?

- Q2a I want my daily steps to be higher than other people
- Q2b I prefer physical activities that are competitive with other people.
- Q2c I would try to improve my ranking if I could see other people's rankings
- Q2d If I am competing against others I would try harder to beat them

Q3 Does a real-world connection influence persuasive strategy preference? (SC)

- Q3a My relationships with others are more important than my successes
- Q3b I consult with others before making important decisions
- Q3c I would sacrifice my self-interest for the benefit of my whānau
- Q3d My whānau would influence my decision to begin a hīkoi to health

Q4 How do the designs resonate with Māori? (MCD)

Q4a The illustrations in this app represent Māori people

Q4b The quests in this app reflect tikanga Māori

Q4c This app is designed especially for Māori people

Q4d This app fits well with te ao Māori

Q5 Do participants perceive the application is easy to use (PEOU)

Q5a I would find this app easy to learn

Q5b I would find this app easy to use

Q5c The text in this app makes it easy to know what to do next

Q5d This app is something I could see myself using on a regular basis

Q6 Would the participants trial the app when it became available? (IU)

Q6a I would use this app when it becomes available

Q6b I would recommend this app to my whānau

Q6c I would like to try a real version of this app

Q6d I would recommend this app to other people

Q7 Would the application work for Māori? (PU)

Q7a This app would help me become more physically active

Q7b This app would help me make healthier food choices

Q7c This app would give me confidence to make healthier choices

Q7d Using this app would give me ideas for becoming healthier

Demographic Questions

Q9: Which age group do you belong to?

Under 18	*specifically exclude children*
18-24 years old	
25-34 years old	
35-44 years old	
45-54 years old	
55-64 years old	
65 years or older	*not specifically looking for non-working age participants but the data might be interesting, so keep responses*

Q10: Which gender do you identify as?

- Tāne (Male)
- Wahine (Female)
- Tāhine (non-binary)
- Prefer not to say

Q11: Which of the following statements best describes where you live?

- In a big city
- In a small city
- In a big town
- In a small town
- In a rural community

Q12: Who usually lives at the same wāhi noho (residence) as you?

Choose all the apply

- Just me
- My partner
- Children
- Parents
- Grandparents
- Friends
- Other relatives

Thank You Screen

Thank you for completing this survey, your responses will be valuable to this research. Here are the contact details again if you think of a question later.

Researcher: Dannie Jefferies (Ngāti Apa) dlj1@students.waikato.ac.nz

Supervisors: Stuart Dillon stuart.dillon@waikato.ac.nz

Karyn Rastrick karyn.rastrick@waikato.ac.nz

John Oetzel john.oetzel@waikato.ac.nz

12.9 APPENDIX I – ETHICS APPROVAL PHASE TWO

The University of Waikato
Private Bag 3105
Gate 1, Knighton Road
Hamilton, New Zealand

Human Research Ethics Committee
Roger Moltzen
Telephone: +64021658119
Email:humanethics@waikato.ac.nz

THE UNIVERSITY OF WAIKATO
Te Whare Wānanga o Waikato

27 October 2021

Dannie Jefferies
WMS
By email: dlj1@students.waikato.ac.nz

Dear Dannie

HREC(Health)2021#80: Using gamification to facilitate positive health behaviour change (Phase 2 of HREC(Health)2018#19)

Thank you for your responses to the Committee feedback.

We are now pleased to provide formal approval for your project.

Please contact the Committee by email (humanethics@waikato.ac.nz) if you wish to make changes to your project as it unfolds, quoting your application number with your future correspondence. Any minor changes or additions to the approved research activities can be handled outside the monthly application cycle.

We wish you all the best with your research.

Regards,

Emeritus Professor Roger Moltzen MNZM
Chairperson
University of Waikato Human Research Ethics Committee

You are invited to be part of a research study exploring different ideas for a mobile phone application to support Māori health. This study is being done by Dannie Jefferies (Ngāti Apa), a doctoral candidate from the University of Waikato and has ethics approval from the University of Waikato (HREC(Health)2021#80).

This study plans to design a mobile health smartphone application to encourage Māori to become more physically active and to make healthy food choices. The results of this study will be published in a PhD thesis, conference papers, and other academic literature, but will not include any information that would identify you personally

People taking the survey should identify as Māori and be at least 18 years old. If you agree to be part of this study you will be shown different ideas for pages to be included in a smartphone health application and asked about your own preferences in an online questionnaire, it should take you approximately 15 minutes.

Participating in this study is completely voluntary, and you may choose not to answer any question for any reason. Even if you begin this survey, you may change your mind and stop at any time.

While you may not receive a direct benefit from participating, others may benefit from the knowledge obtained in this study. We believe there are minimal risks associated with this research study; however, a risk of breach of confidentiality always exists and to minimise this risk, we will not be collecting any information that could be used to identify you personally.

If you have any questions about this study or wish to contact the researcher team you can use the contact details below. These contact details will be shown again at the completion of the survey if you think of a question later.

Researcher:	Dannie Jefferies	dlj1@students.waikato.ac.nz
Supervisors:	Stuart Dillon	stuart.dillon@waikato.ac.nz
	Karyn Rastrick	karyn.rastrick@waikato.ac.nz
	John Oetzel	john.oetzel@waikato.ac.nz

By clicking "I agree" below you are indicating that you are at least 18 years old, have read this consent form and agree to participate in this research study. You are free to skip any question that you choose. Please print a copy of this page for your records.

I agree	I do not agree

12.10 APPENDIX J – FACEBOOK POSTS

These Facebook posts are three examples of recruitment attempts. The first two resulted in approximately 25 respondents completing the survey. Following the third post, the number of respondents grew to 377 survey completions.