Adult Facilitators Creating a Space for Children to Co-Design a Toothbrushing Game to Promote Oral Health

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Abstract

Children have the capacity to become prosumers of oral health through co-designing oral health games to prevent dental caries. New tools and opportunities are opening up in the digital world context, including the applicability of serious games in oral health. This research project aims to explore ideas from adult participants in their role as game co-design facilitators to create a space for children. Participatory Action Research (PAR) methods were used in this research with a child-centred focus. The research project used PAR with seven adult participants, from different disciplines, interested in working with children. Participants engaged in participatory workshop discussions to explore ideas for creating a space for children to co-design a toothbrushing game.

The findings from this research project indicate a gap in conducting research in partnership with children, to co-design oral health promotion activities. They support the creation of tools for promoting children's voices, and co-design practices. One such tool developed in this study is that of an adaptable lesson plan, with the possibility of multiple adaptations in teaching, guided by the New Zealand Curriculum. An adaptable lesson plan is proposed to be used by teachers, or adult facilitators, to guide them in creating an innovative space for children to co-design oral health games in a child-centred environment. Data analysis in PAR is an iterative process involving the participants' collaboration and reflection to interpret the data. The researcher undertook an initial data analysis using thematic analysis and listed key points reflecting the adult facilitators' main concepts. Completion of data analysis resulted in five themes; what is a game? introducing children to games, creating a space for children, children-centred membership, and fun and gainful for children. The themes were presented to the adult facilitators for their verification as part of the collaborative PAR process. In summary, the data analysis, theme development, co-designing principles, prosumerism, and PAR principles with children contributed to developing an adaptable lesson plan as an example of a practitioner tool (artefact).

The themes provided the ideas, tools, and guidance to create an adaptable lesson plan that reflects the adult facilitator's concepts. An adaptable lesson plan, as a teaching tool, opens possibilities to support teachers, and adult facilitators, to collaborate with children in a child-centred environment, to co-design a toothbrushing game. Inquiry is described as a two-way process in teaching and learning. Teachers and children use inquiry processes to gain knowledge—teachers through teaching as inquiry and children through inquiry-based learning. An adaptable lesson plan aims to support teachers, or adult facilitators, to create a space for children to become co-designers in oral health.

Collaborating with children in partnership provides opportunities for children to become prosumers of oral health with the possibility and potential to challenge oral health policymakers. However, child-centred approaches where children participate in partnership as co-researchers and express their views and voices in oral health programmes, require further exploration.

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Attestation of Ownership

I hereby declare that his submission is my own work and that, to the best of my knowledge and belief, it contains no material previously published or written by another person or material which to a substantial extent has been submitted for the award of another degree or diploma for a university or other institution of higher learning.

Daniel Fernandez

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Ethics Approval

Ethics approval for this research project was granted by the Auckland University of Technology Ethics Committee (AUTEC) on 3 November 2020, approval number 19/285.

After the application was submitted, AUTEC made minor recommendations that were addressed immediately and submitted for final approval. Approval was granted.

Chapter 1 Introduction

1.1 Introduction

The World Oral Health Report 2003, from the World Health Organization (WHO), indicated that dental caries in children, also known as dental decay, continues to be one of the most common oral diseases, particularly in low socioeconomic and underprivileged populations, in both developed and developing countries (Petersen, 2003; Reddy, 2018). This research explores the ideas and creative possibilities of adult facilitators interested in teaching children by creating co-designed toothbrushing games with children.

This project proposes that children from Years 7 and 8 (ages 11 to 12) from New Zealand schools be given opportunities to share co-design of toothbrushing games as serious games to promote oral health to prevent dental caries (Melonio & Gennari, 2013; Stedjeberg, 2017). Serious games are digital games that promote knowledge through pedagogical and motivational components (Caserman et al., 2020). They place the player at the centre of the game by allowing continued interaction, repetition, and feedback on performance (Drummond et al., 2017; Rodrigues et al., 2020). They encourage the player to continue playing and learning by making choices, taking risks, and promoting positive behaviour change (Baranowski et al., 2016; Caserman et al., 2020)

A facilitator is a person who helps and supports the participation of group members to work toward an objective or goal (Bens, 2000; Kaner et al., 2014). This research is about listening to children's voices; however, it is essential to note that the participants in this project are not children. Instead, the participants were adults from different disciplines. Therefore, the term adult facilitators will be used in this thesis. The rationale for working with adults instead of children is explained in section 1.9.

Children like games and creating a game does not necessarily need to use technology. In a teaching situation, children can use different materials to create a game, such as paper, cardboard, pencils, plastics, fabrics, paint, toys, and other materials. An example is the creation of games for rainy days (Te Kete Ipurangi, n.d.), as explained in the study design section, and where they do not require to have a network to play the game. Should children have access to technology (e.g., computers or digital devices), they could use tools (e.g., videos, photos, and voice recording) or develop an App that could be used on a smartphone to promote oral health using the internet. There is also the possibility that they could use a combination of approaches. I will refer to games and Internet-based games as oral health games. A prosumer is a person consuming goods and services and producing a particular product or commodity (du Plessis, 2018). Children as

prosumers have the potential to use technology in fun ways by using social media tools to promote their toothbrushing game, whether the game is designed with available materials or digitally created.

Efforts to promote and encourage children to brush their teeth have been focused mainly on the idea that children have inadequate knowledge and motivation about oral health. Health and well-being education alone do not significantly change children's attitudes and behaviour toward improving their oral health (Jacobson et al., 2019). There is evidence that children's learning is more substantive when fun activities, such as games, are integrated with education because this creates motivation and provides knowledge (Malik et al., 2017). Game-based teaching reinforces learning and motivates students to continue learning. Simple games (e.g., board games) can be used for teaching oral health and can be co-designed by children with the potential to be shared with their friends, family, and communities using digital technology.

1.2 Background

Dental caries is a preventable chronic disease affecting children and adults in all parts of the world. The contributing risk factors of this disease are complex, but main factors are related to social, behavioural, cultural, dietary, and biological determinants. The association of the complexity of these factors with dental caries creates a challenge for oral health professionals to eradicate and prevent this disease (Masood et al., 2012). Additionally, limitations to oral health care and lack of treatment negatively affects children's health, well-being, and quality of life (Mota-Veloso et al., 2016).

Dental caries starts when cariogenic bacteria produce acids that, in contact with the tooth surface or enamel, gradually demineralise the enamel, causing a carious lesion or a cavity. Untreated dental caries cause tooth pain, difficulty chewing, and inability to eat properly (Petersen et al., 2005). It can affect the person's self-esteem, causing embarrassment that leads to poor quality of life for the individual affected, the family and, consequently, society (Souza et al., 2018). Other consequences of dental caries are poor school attendance and lack of children's participation in school activities (Konthoujam & Kalita, 2020); and, in the case of adults, poor performance at work causing lost hours (Petersen et al., 2005).

The prevalence of dental caries worldwide seems to be high in underprivileged populations, with people accessing and eating food with high sugar content, having a low educational background, poor living conditions, and inadequate access to dental care services (Petersen & Ogawa, 2016). The Oral Health Report 2003 outlines that the

caries experience in developing countries, including in the Pacific region, is more significant than in developed countries (Petersen, 2003). Dental caries experience has declined, to some extent, in developed countries due to the introduction of fluoride in the community water supply, even though the levels of sugar consumption remain unchanged (Petersen et al., 2005). However, even with the introduction of community water fluoridation, dental public health interventions, and oral health promotion programmes, developed countries are still experiencing a high incidence of dental caries, particularly in underprivileged communities (Petersen, 2003). New Zealand is a developed country with multicultural and diverse ethnic communities (Stats NZ, n.d) and with high levels of inequity and poverty (Nelson, 2016). Māori and Pacific people experience high levels of poverty and dental caries in children and adults than other ethnic groups (Ministry of Health, 2021a; Nelson, 2016).

1.3 Oral Health in the Pacific Islands

In the last few years, the diet of the Pacific Islands' population has increasingly changed as a result of easy access to imported food with high sugar content affecting the production of traditional local food. Local traditions such as agriculture, hunting, and fishing have been affected as imported processed food is easy to access, cheap, attractive, different from traditional food, and convenient. People living in urban areas are more affected by this accessibility and diet changes than people in rural areas (Aldwell et al., 2018; Connell, 2014). As a consequence of these changes, the Pacific Island communities are now suffering from poor oral health and other diet-related health conditions such as obesity, diabetes, and heart diseases, which have contributed to an increase in non-communicable diseases (NCDs) (Aldwell et al., 2018; Ministry of Health of Vanuatu, 2015).

Populations around the world are growing and the population in the Pacific Region is no exception. As the population of the Pacific Islands grows, demands and pressure from their communities to provide food increase. These demands force governments to trade with stronger economies. The economies of the Pacific Islands are small and with limited resources which puts them at a disadvantage against larger and more powerful economies that are dominating and impulsive about trade policies that benefit them (McLennan & Ulijaszek, 2015).

It is apparent that dental caries in the Pacific Islands is increasing due to commercial trade, easy access, and consumption of food with high sugar content. A study by Speake et al. (1979), showed that the rate of dental caries in the Pacific Islands was very high,

particularly in the French Polynesia (5.2 DMFT score for 11-year olds), and Cook Islands (6.0 DMFT score for 11-year olds) due to the consumption of sugar in food. The experience of dental caries is measured by using the index of decayed, missing, filled teeth (dmft/DMFT) (Doherty et al., 2010). Speake et al. (1979) concluded that as long as there is an increase in the consumption of sugary food, the prevalence of dental caries will also increase.

1.4 Access to Oral Health Care Services in the Pacific Islands

It is well documented that inadequate access to oral health care services contributes to high levels of dental caries and its effects, such as pain and tooth extraction. The impact of dental caries and gum diseases varies from region to region, and from country to country, including in the Pacific Islands (Petersen, 2003).

It is observed that in the Pacific Islands, oral health services are accessible but more costly in urban than rural areas (Aldenhoven, 2015). Irregular transportation to small islands, and especially in rural communities where access through road networks is not possible, is another contributing factor for people not accessing health services (Livtunvanu, 2011). Additionally, in rural areas, oral health services are delivered mostly by underqualified or non-qualified health workers in an attempt to alleviate the lack of services (Steel, 2013).

1.5 Diet in the Pacific

The traditional food of the Pacific Islands is low in sugar content and mainly consists of vegetables, roots, fruit, and seafood (Aldwell et al., 2018). Local products have become more expensive as the growing of fruit and vegetables takes time, and it is hard to produce large quantities using traditional tools and techniques (Aldwell et al., 2018). Food production also depends on land availability, accessibility, and land tenure (Ministry of Health of Vanuatu, 2015).

The practice of traditional fishing has been affected by the introduction of imported meat; rice; and canned, processed, and preserved food (Aldwell et al., 2018). Imported food from other countries is forcing a change of diet in the Pacific Islands (Aldwell et al., 2018; World Health Organization, 2007b).

It is also apparent that the globalisation of the Pacific Islands has led to changes in lifestyles. The countries of the Pacific region are heavily import-dependent on countries

around the region or with high economic links (Snowdon et al., 2013). Tobacco and alcohol are also examples of how imported products have impacted the Pacific people's health (World Health Organization, 2007b).

In recent years, the prevalence of NCDs, such as obesity, diabetes, and cardiovascular diseases, have increased as a result of the influence and consumption of imported products (World Health Organization, 2007a). Obesity in children and adults, for example, has become a significant public health problem for the Pacific Islands (Aldwell et al., 2018). Obesity is linked to poor diet which in turn is linked to poor oral health due to the high consumption of imported products with high sugar content (Aldwell et al., 2018).

Imported sweetened drinks are especially attractive to children and the high consumption of these beverages has impacted people's oral health and weight gain (Aldwell et al., 2018). Some beverages are sold in schools where children have easy access to them. Taste, texture, presentation, smell, and other marketing characteristics of imported products have made people want to taste or try them, which increases their desirability to have them (Aldwell et al., 2018). Children like to consume sweets, and the frequent high consumption of sweets is very common in school children, to the extent that it affects their oral health. This happens in both developing and developed countries (Alrmaly & Assery, 2018; Doherty et al., 2010).

1.6 What are the Governments of the Pacific Region Doing?

Governments of countries from the Pacific region have had limited control over the influence of the private sector on social and economic factors that affect the general health of their populations. However, in recent years, Pacific Governments have taken the initiative to influence their people to appreciate their local products and promote the production of their own food (World Health Organisation, 2019). One of the reasons for this action is that these governments are increasingly concerned about the impact on general health of the high consumption of imported products as well as the financial cost of importing expensive ingredients that are not part of the Pacific cuisine (World Health Organisation, 2019). The aim of these initiatives is to discourage people from purchasing imported, unhealthy products so as to reduce the burden of NCDs. Farmers are strongly encouraged to produce sufficient local and traditional healthy food that is part of the staple diet (World Health Organisation, 2019).

The Vanuatu national plan of action on food and nutrition security (Ministry of Health of Vanuatu, 2015) emphasises the effects of poor diet choices as a consequence of imported products in the Pacific Region. Illnesses related to under-nutrition such as

anaemia and goitre, or over-nutrition illnesses such as obesity, diabetes, and heart diseases, have contributed to an increase in the prevalence of NCDs. Concerns about the prevalence and burden of these conditions have created interest in the governments of the Pacific Islands (World Health Organisation, 2019).

In Vanuatu for example, it has become popular for mothers to buy imported food with high sugar content for their children as it is cheap and attractive (World Health Organization, 2007a). Thus, mothers are being encouraged to buy local foods such as potatoes, bananas, and snacks(e.g., manioc chips) that have more nutritional value than imported foods (World Health Organization, 2007a).

It is common for people from developing countries to have limited knowledge and understanding about the cause of dental caries, its consequences, and how it can be prevented (Alrmaly & Assery, 2018). This is the case in the Pacific Islands where people have high caries levels due to lack of education and motivation relating to oral disease (Willie, 2017).

1.7 Dental Caries in New Zealand

The Pacific Islands is a region in the Central Pacific Ocean with more than 25,000 islands and 25 nations and territories. The Pacific Islands comprise three groups: Melanesia, Micronesia, and Polynesia. New Zealand is geographically located in the Polynesian Island group (Costa & Sharp, 2011). It is the largest country of the Polynesian Islands in terms of area and population (World Population Review, 2022) and has a strong political and economic influence within this group (Bertram, 2010).

New Zealand's population comprises diverse ethnic groups. The 2018 Census indicated that New Zealand has six major ethnic groups: European, Māori, Pacific peoples, Asian, MELAA (Middle Eastern/Latin American/African), and 'Other ethnicities' (Stats NZ, n.d).

It is well documented worldwide that socioeconomic and ethnic inequalities are indicators influencing poor oral health in children and adults living in developing and even developed countries where dental care is funded, such as New Zealand (Shackleton et al., 2018). Children in New Zealand receive free dental care funded by the Ministry of Health through oral health services from birth to their 18th birthday (Health Promotion Agency, 2015; Kanagaratnam & Schluter, 2021). Despite dental care for children in New Zealand being government funded, large differences in ethnicity, living area, and socioeconomic deprivation exist (Shackleton et al., 2018). Inequalities in oral health in children based on ethnicity were reported in the 1980s (Ministry of Health, 2010), and in 2003 it was made clear that the ethnic groups with higher prevalence of dental caries

and inequalities in oral health were Māori and Pacific children (Public Health Advisory Committee, 2003). More recently, a report published by Healthy Auckland Together (2017) indicated that Pacific children have the highest dental caries experience followed by Māori children—more than any other ethnic group in the Auckland region.

A study conducted by Thornley et al. (2021) to identify the factors associated with early childhood caries (ECC), found that ethnicity is strongly related with dental caries, particularly in Pacific children. This evidence is supported by the 2020 data from the Community Oral Health Service for the Auckland region. The data show that 42% of 5-year old children and 33% of 12-year old children had dental caries; with Māori and Pacific children being the most affected (Ministry of Health, 2021a). Kanagaratnam and Schluter (2021), identified that adolescents are more vulnerable to oral health changes and develop dental caries as they are easily influenced by their peers and the media about drinking and eating food with high sugar content.

Dental care for children from birth to school Year 8 (age 12–13-years) is provided by Community Oral Health Services (COHS) from District Health Boards (DHBS). Children from school Year 9 (age 13–14-years) to age 17-years receive oral health care from the Adolescent Oral Health Services (AOHS) scheme through private practices or dentists. Despite efforts from the COHS to provide dental care for all Year 8 children before they are transferred to the AOHS, they are still not meeting the target. Kanagaratnam and Schluter (2021) identified that the reasons include a shortage of dental practitioners in the COHS, or that Year 8 students were absent from school at the time the appointment was scheduled, or the appointments are cancelled for various reasons.

1.8 Researcher's Interest

As an oral health practitioner, I had in mind the possibility to have a game in oral health created by children to be used by children to prevent dental caries. This thought came as a result of reading an article about a Japanese game called Tamagotchi. Tamagotchi is a handheld digital game/pet (artificial pet) where the player feeds the pet as much or as little as they want to keep it 'alive'. The game/pet encourages the player to feed, clean, and love the pet for it to survive. The game/pet promotes a feeling of responsibility to care for something in the player. If the pet is not fed consistently, properly, or not at all, the pet's health starts deteriorating or eventually the pet dies (Hamid & Ismail, 2007). Based on the Tamagotchi game concept, I thought about the idea of a similar game in oral health where the teeth are the 'pet', and the toothbrushing is the 'food', wherein teeth will be cleaned and healthy if they are brushed regularly. If the teeth are not brushed

consistently or not at all, then the teeth will start deteriorating with dental caries and eventually get infected.

Based on the above idea, the initial proposal to conduct this research started with a study design based on addressing the public health problems of dental caries in Pacific children, specifically children from Vanuatu. The interest in conducting research with Pacific children was based on the AUT School of Oral Health initiative to provide oral health care to Pacific seasonal workers from Vanuatu who come to New Zealand for six months. As an oral health practitioner and academic staff at the AUT School of Oral Health, I participate in the delivery of oral health care for seasonal workers every year. As part of the programme, the seasonal workers developed a video highlighting the need for oral health education and services for children and adults in Vanuatu. After seeing this video, I decided to conduct research with children in Vanuatu and submitted the research proposal to the university. I decided to follow the Format Three thesis structure (See section 1.112 Overview of the Thesis on page 22) as this structure focuses on the research site more than the theory. Also, a Format Three thesis allows the creation of an artefact that can be used as a practice-oriented tool to conduct further research.

Oral health promotion traditionally focusses on addressing social, political, and environmental factors to reduce health inequalities and improve dental care access to communities (Reddy, 2018) without considering the community's participation in addressing the problem and finding solutions that reflect their experiences. It is common practice for oral health policy makers to override children's right to participate in research and to develop health programmes in partnership with those who are 'voiceless' but who have an enormous capacity to contribute to the design of these programmes. My research interest is the creation of a space in a teaching environment that promotes children's engagement to co-design a toothbrushing game as a serious game to promote toothbrushing and to make oral health policymakers aware of the need to include children in policy-making decisions.

1.9 Researcher's Journey in this Research Project

As the researcher, I went through a learning process from my initial thoughts to the findings of the study. I contacted a group of dental researchers in Vanuatu to support my proposal to conduct research with children. After a few months and an effort to maintain consistent communication, I could not find a secondary supervisor to support the research proposal. Internet access in Vanuatu is limited and slow, which was one of the main barriers to maintaining communication. As this was unsuccessful, I needed to

change the participant group from the initial proposal. Instead of visiting and conducting research in Vanuatu, I was advised by my supervisors to change the direction of the proposal by recruiting Pacific children living in Auckland. I submitted an ethics application to AUTEC to recruit 11- to 12-year-old Pacific children from intermediate schools in Auckland. AUTEC approved the proposal.

I contacted intermediate schools with a high percentage of children from Pacific communities in Auckland. However, only two schools agreed to support my project, to which I sent information about the study with consent forms and participant information sheets. I then arranged to collect the data with the schools. However, the schools declined their support due to the COVID-19 pandemic and social distance restrictions in Auckland. The schools were under extreme pressure to meet their curriculum requirements, were concerned about the effects and spread of the coronavirus, and the uncertainty of the social distancing restrictions. Next, I approached secondary schools in Auckland to recruit 13 to 16-year-old Pacific children, but this was also unsuccessful due to social distancing restrictions. Once again, I needed to re-consider the participant group, which took time to plan due to the uncertainty of COVID-19 effects and restrictions.

My supervisors suggested changing the direction of the research project by recruiting AUT Education School students and Oral Health students (as adult facilitators) instead of children. Therefore, a new ethics application was submitted to AUTEC to approve the change and to recruit final year students from the Bachelor of Education and Bachelor of Health Science in Oral Health. Ethics approval was gained on 11 November 2020, reference number 19/285 (Appendix A). As a result of the late ethics approval, time was crucial to recruit the participants before leaving the university.

Once again, I had difficulty recruiting student teachers. Several invitations to participate in the research project were sent to the student teachers through the student communication platform (Blackboard), but no one volunteered to participate. However, volunteers from other disciplines, including final-year oral health students, responded to the invitations through colleagues via word of mouth and emails. Finally, I managed to recruit 7 adult facilitators who volunteered to participate. The effects of the COVID-19 pandemic in New Zealand significantly impacted the design of this research project.

I started by exploring the literature about oral health promotion for children and, in particular, literature about the use of serious games in oral health (Rodrigues et al., 2020; Zaror et al., 2021). I found that serious games have been used in health disciplines to educate people and make changes in their behaviour. However, I also found limited research using serious games in oral health. Of the literature located, addressing serious games in oral health, there was no indication whether children were consulted or

included in the design of the games. Thus, the interest in exploring the proposal that children co-design their own toothbrushing game to promote oral health.

I came up with the idea to conduct a research project to develop ideas for the creation of a space, opportunities, and an environment in which children are the co-designers of their own toothbrushing game. I needed to consider what methodological approach could be used for this research project and thought about Participatory Action Research (PAR) (MacDonald, 2012). As a novice in this area, I planned and conducted a peer group exercise using PAR techniques to give me an idea about how to conduct a workshop with adult facilitators and to get the most from their participation. For the peer group exercise using PAR techniques, I did the following:

- Introduced the purpose of the activity to the peer group.
- Conducted an ice-breaker activity.
- Asked the peer group to work in small groups to allow participation and discussion.
- Provided material resources (e.g., paper, coloured cardboard, markers, colour pencils, sticky notes, etc.).
- Video recorded group participation and took photos to practise maintaining the protection of participants' identities.
- The groups presented their work and discussed their drawings.
- Feedback was given about the exercise.

The peer group exercise provided me with helpful feedback about what areas to improve such as having someone to help with recording of the session, taking pictures, organising material resources, time keeping, and even organising the catering for the adult facilitators.

Based on the feedback received, I invited 7 adult facilitators from different backgrounds with an interest in teaching to take part in workshop activities to provide their ideas and creative opportunities to create a space for children to co-design a toothbrushing game using PAR. Four oral health students participated in the workshop activities for content support and guidance. The workshop was one session of 60 minutes duration. The adult facilitators started developing their ideas using brainstorming, sketching, and drawings. Paper, markers, coloured carboard, sticky notes and other stationery items were provided to create their posters. Two adult facilitators used a laptop and an iPad to search for pictures and design a chart. One participant used a smartphone to search for pictures and games.

The adult facilitators were active participants and co-design partners with the support of the oral health students in the workshop activities to produce useful concepts and ideas.

After the adult facilitators finished their discussions, they presented their posters to the other adult facilitators. During the presentation, the adult facilitators explained relevant discussions, ideas, and concepts and compared them with those of the other groups. The comparison of their posters created a rich discussion of similarities and differences in their concepts.

The findings from the workshop activities, the shared poster presentations and discussions, my own experience as an oral health practitioner and educator, combined with findings from the literature reviewed, had an impact in my research project. The findings provided me with ideas, tools, and guidance to create an adaptable lesson plan that reflected the adult facilitators' concepts. The findings also supported the content of the lesson plan in promoting children's voice, and co-design practices with the possibility of multiple adaptations in teaching guided by the New Zealand Curriculum. Additionally, the lesson plan functions as a future co-design plan to promote a space for children to co-design a toothbrushing game.

1.10 Research Question

The research question I sought to address is:

How can adult facilitators create a space for children to co-design a toothbrushing game to promote oral health?

Based on the literature review and the experiences from the primary data collection workshop, I developed the following sub-questions:

1. How can adult facilitators help create a space for children to co-design a toothbrushing game to promote oral health?
2. What do we currently know about the use of serious games in oral health promotion?
3. What educational tools, such as a lesson plan, may support the adult facilitator in oral health promotion co-design with children?

The aim of the research was to explore with adult facilitators how to create a space for children to co-design a toothbrushing game to promote oral health. Therefore, the research involved the development of a potential and adaptable lesson plan, as a tool to support and guide teachers to create a learning space supportive of co-design for students. The applicability of the adaptable lesson plan will support teachers and adult facilitators in oral health in the teaching and promotion of oral health to prevent dental caries as guided by the key learning of personal body care from the New Zealand

Curriculum (Ministry of Education, 1999). It may also feed into the oral health promotion taught to students through functioning as a tool to provide students with the necessary learning resources, strategies, and learning opportunities to promote developing co-designing approaches to co-designing a toothbrushing game as a serious game.

1.11 Contribution of the Research to Oral Health Promotion

The application of elements of a lesson plan as a teaching tool using PAR, will ideally be of interest to school teachers and other adult facilitators involved in oral health promotion. In particular this will be of interest in schools, clubs and other settings where there is a high percentage of children and young people from Pacific communities. The project findings may have applicability to other communities or areas in New Zealand with high prevalence of dental caries to promote awareness and the role of children in advocacy for oral health promotion interventions available and appropriate for New Zealand. The findings from this research project aims to add knowledge about the gaps that exist in research including children as researchers of their own interests, taking control of their own co-designs in oral health promotion.

1.12 Overview of the Thesis

This thesis provides an analysis of exploration of adult facilitators in the creation of a space for children using PAR to co-design a toothbrushing game to promote daily toothbrushing. The thesis follows a Format Three thesis structure. A format three thesis is based on practice-oriented research that includes an artefact and the exegesis. The format three thesis aims not to illustrate the theory but to focus on the site of research. The knowledge generated from this research will contribute to my professional practice as an oral health educator. The artefact, in this thesis, is presented as the adaptable lesson plan.

The thesis contains six chapters. Chapter 1 has provided an overview of dental decay (dental caries) in children as a public health problem in New Zealand and in Pacific communities. Chapter 2 provides an in-depth review of the literature on the digital era; the Internet and the Web; and the role of children as consumers, producers, prosumers, and co-designers. Chapter 2 also critiques the effectiveness of toothbrushing programmes in schools and proposes the inclusion of children to participate in action research to co-design their own toothbrushing game, which is the foundation of this research. Chapter 3 outlines the methodology used to support this research project,

methods used, recruitment process, data collection, and the different stages of the ethics approval.

Chapter 4 is the critical commentary part one; it presents the findings and their interpretation. It provides a deep analysis of the adult facilitators' ideas and creativity to encourage children to become co-designers. Chapter 5 is the discussion chapter, the critical commentary part two. In this chapter, I discuss in-depth the workshop findings and how PAR with children can lead to the development of a lesson plan. I propose an adaptable lesson plan, as the artefact of this research project and in response to the research question, with the aim to develop children's skills in co-designing a toothbrushing game to promote daily toothbrushing. Chapter 6 presents the conclusion, future contributions, and limitations of this research.

Chapter 2 Critical Literature Review

2.1 Introduction

A critical literature review of a topic is one where literature has been extensively analysed to a critical level to the extent that it enables the development of new concepts (Grant & Booth, 2009). The role of the critical review in this research focuses on the analysis of existing knowledge about children's potential to become co-designers in oral health. A critical review may also, as is the case here, follow the philosophical approach of critical theory.

Critical theory is a social theory that analyses and critiques societies, cultures, and political domination by applying knowledge from the social sciences and humanities with the aim to uncover and challenge power structures to change society (Crossman, 2020). There is a tendency for children's social, cultural, and political context to not be recognised as important; therefore, the inclusion of children in research tends to be ignored (Horgan, 2017). Challenging power structures recognises that children have the capacity to actively participate in society and to contribute to research (Ritterbusch et al., 2020). Furthermore, studies involving children promote social inclusion and allow children to develop their skills in evaluating, analysing, and making decisions to change the way they live and contribute to the development of their communities (Cahill, 2016).

This literature review adopts an analytical approach to current knowledge, informed by critical theory, with an aim of challenging power structures (Crossman, 2020). This challenge is supported by existing literature on oral health games designed by children to promote oral health. Therefore, the literature review will also look at the power relationship between children and adults in conducting research and co-designing oral health promotion games (Schubotz, 2020). Internet-based tools, oral health promotion, and serious games, as well as the emerging theories around prosumerism, will be reviewed in order to support the aim to encourage children to co-design their toothbrushing games.

The review of literature about the use of serious games in oral health revealed that there is little to no research conducted that includes children as co-researchers in the design of these games. It is likely that this is because of the newness of the area of Internet-based oral health promotion; however, it also signifies a gap in the inclusion of children, their advice, participation, and collaboration in the design of serious games for oral health. Children and adolescents constantly use the Internet, and they quickly develop skills using technology to find information they want. Children use the Internet to search for, create, and share information through social media platforms; or engage in recreational

activities such as games (Park & Kwon, 2018). The gap in this area of oral health offers opportunities for further studies and research with children as the primary researchers in co-designing their own oral health promotion games.

2.2 The United Nations Convention on the Rights of the Child

The United Nations Convention on the Rights of the Child (UNCRC) 1989 emphasises that children are human beings and have the same rights as others (Groundwater-Smith et al., 2015). However, in society, children typically do not participate in politics or policy-making decisions concerning their well-being; therefore, policy makers override their rights and, consequently, children's voices and opinions are ignored (Groundwater-Smith et al., 2015).

The UNCRC is divided into three sections and contains a total of 54 Articles that clearly stipulate the rights of children (United Nations, 1989). In general, the UNCRC entitles children with a range of rights such as the right to express their views and opinions, be informed, place their best interests first, access to free education, and enjoyment of standards of health and living, among other rights (Groundwater-Smith et al., 2015). Given that children are active members of families, communities, and societies, Article 12 recognises that they have the right to express what they think about all matters affecting them. Accordingly, their concerns, interests, voice, and points of view should be taken seriously, or they should have someone who can represent them in any judicial and/or administrative proceedings (Groundwater-Smith et al., 2015; Loveridge, 2010; United Nations, 1989).

In order to comply with Article 12, and to listen to children's voices in an environment where they can freely express their opinions as active advisors and contributors (Loveridge, 2010), PAR group activities can be utilised. Group activities such as puppetry, storytelling, role play, video, photography, and mapmaking are some of many methods that could be used (Horgan, 2017). PAR is a way of engaging children in research and any method used or implemented in the process is just a token, as it is more about the social relationship that plays an important aspect in the production of knowledge (Horgan, 2017). Thus, children's rights signal the significance of involving children as co-designers in developing oral health promotion programmes and activities.

2.3 The Effectiveness of Toothbrushing Programmes in Schools

Dental caries in children is a public health issue and efforts to prevent caries, such as oral health education and toothbrushing programmes in schools, have been implemented in some countries (Woodall et al., 2014). Schools offer the right setting to promote health and oral health for children and for them to learn about their oral health (Gill et al., 2009; Gowda & Croucher, 2011). The WHO recommended that primary school-based supervised oral health and toothbrushing programmes are an alternative strategy for caries prevention in children (Cakar et al., 2018; Petersen, 2003).

Yekaninejad et al. (2012) conducted a study in Tehran targeting parents and schools to increase the frequency of toothbrushing in schools. Rosema et al. (2012) measured the gingivitis and plaque scores of children participating in a toothbrushing school programme in a Burmese school. Akkaya and Sezici (2021) investigated the effect of appropriate toothbrushing behaviours and plaque accumulation using fun activities with games, toys, and visual aids in preschool children in two Turkish kindergartens. Cakar et al. (2018) evaluated the effectiveness of a toothbrushing programme to reduce caries in a school from a low socioeconomic area in Queensland, Australia.

Although there is interest in implementing school-based toothbrushing programmes with the aim to reduce dental caries in other countries, there have been few school-based toothbrushing projects in New Zealand. The majority of these studies have been in Northland. Northland is an area with high rural, lower socioeconomic, and high population of Māori with the highest dental caries rate in children (Gowda & Croucher, 2011).

Clark et al. (2018) conducted a study in five schools in Northland to evaluate the effectiveness of a toothbrushing programme to improve oral health related quality of life. The authors reported that the toothbrushing programme was successfully implemented and was effective and that oral health related quality of life improved more for children who participated in the programme. The authors reported that the project was well organised as it did not interfere with school activities, and that it was supported by the schools and teaching staff.

Ali and Dones (2013) investigated the effectiveness of supervised toothbrushing programmes in four Decile 4 schools in Northland as an effective oral health promoting strategy. Contrary to Clark et al. (2018), the researchers reported mixed results on the success of the toothbrushing programme and recommended that future studies need to be fully supported by teachers and the community. The project was not fully supported due to insufficient committed clinical staff and, as a result, the study did not have a robust

evaluation. Other difficulties in the conduct of this project were the constant withdrawing of children from the programme for various reasons. Out of 240 children participating in the study, only 40 children completed the programme. There was a lot of enthusiasm from children, parents, and teachers at the beginning of the project, but this gradually declined, and the programme started to fall apart. The feedback from the teachers was that it was difficult to balance teaching activities with the toothbrushing programme. They claimed that the programme required a lot of time and effort, and there were health concerns as there was spit all over the classrooms (Ali & Dones, 2013).

Gowda and Croucher (2011) conducted a school-based toothbrushing programme in a high caries risk primary school in Opononi, Northland. Opononi is a highly deprived rural area with no fluoridated drinking water. Gowda and Croucher (2011)concluded that the toothbrushing programme was successfully implemented as a routine and that the teeth of children participating in the programme were cleaner with healthier gums. They also reported that at the beginning of the programme the project was well supported by teachers, but this declined towards the end of the programme. Children's participation in the programme was low. Teachers indicated that the toothbrushing programme was disorganised and unsupported by the research team. Toothbrushes were of poor quality and their storage in classrooms was difficult. Teachers were of the opinion that toothbrushing was parents' responsibility and should be done at home. The dental team participating in the delivery of the programme was enthusiastic about the project but some of them were of the opinion that the programme was too long, disorganised, and not well coordinated. The dental team also expressed their disappointment at not being included and considered in the planning of the programme.

Another study by Clark et al. (2018) assessed the effectiveness of a school toothbrushing programme in reducing dental caries experience in children in Northland. Their study is the largest toothbrushing programme in New Zealand. Clark et al. (2018) reported that a supervised school toothbrushing programme can reduce dental caries in a population with high levels of dental disease. The authors did not report any difficulties encountered in the conducting and implementation of the toothbrushing programme, apart from some children not completing the programme because of not attending school for various reasons.

It is evident that school-based toothbrushing programmes positively educate, reduce, and prevent dental caries in children, especially in deprived areas where dental caries rate is high (Clark et al.,2018). While researchers make a strong effort to conduct and implement toothbrushing programmes in schools to reduce or prevent dental caries in children, there is no indication of the effectiveness of these programmes after children leave the school.

Woodall et al. (2014) questioned whether the implementation of toothbrushing programmes in schools make any difference to brushing at home and recommended that further studies are needed to investigate this area. Rosema et al. (2012), for example, concluded that their study did not demonstrate satisfactory results in the score of gingivitis and plaque levels from children participating in the toothbrushing programme and questioned the usefulness of these types of school programmes.

Toothbrushing programmes conducted in schools report on their effectiveness, but they fail to report the difficulties encountered during the programme delivery. It is also evident that researchers face difficulties and limitations in conducting such projects in schools where they require complete support from parents, teachers, and the community. Akkaya and Sezici (2021) reported that the limitations of their study included low participation of parents and teachers and that school activities affected the children's toothbrushing practices. Gowda and Croucher (2011) reported similar limitations.

A study of a school-based toothbrushing programme conducted by Woodall et al. (2014) in Yorkshire and Northern England, reported the success of the implemented toothbrushing programme as well as the difficulties faced in the coordination and delivery of these programmes. Many school oral health programmes and interventions are poorly and inadequately evaluated, making their effectiveness challenging to assess (Watt et al., 2001). Despite school-based oral health programmes increasing, as recommended by the WHO to reduce dental caries in children, most of these programmes do not produce a sustained effect or long-term impact on children's behavioural change at home (Cooper et al., 2013; Malik et al., 2017; Watt et al., 2001). The coordination and delivery of such oral health interventions in schools are challenging as multiple factors must be considered for their success. Woodall et al. (2014) identified many challenges associated with coordinating and delivering a toothbrushing programme in schools. Some of these challenges have been already indicated by Ali and Dones (2013), Clark et al. (2018), and Gowda and Croucher (2011) and include:

- School characteristics
- Lack of participation from children
- Barriers in organisation and delivery of toothbrushing programmes
- Support and training of staff in the delivery of programmes
- Staff and teachers' perspectives about extra-curricular activities added to their duties
- Inconsistencies with staff retention in schools and in the programme
- Oral health staff not supported by school staff
- Teachers' perspectives that their educational role is replaced as pseudo-parents

While a deeper discussion on this topic and a long list of difficulties could be written about conducting such toothbrushing programmes, alternative approaches could be explored instead. Also, these programmes are place- and time-bounded, requiring planning, organisation, and financial cost; it could be argued that involving children in Internet-based initiatives allows for greater effectiveness and reach beyond the space of schools.

2.4 Efforts to Improve Oral Health in New Zealand

In 1921, New Zealand established the School Dental Service (SDS) as a response to children's poor oral health (Moffat et al., 2017). School dental nurses were educated to provide basic dental care to children in primary schools in a public school dental service (Nash et al., 2014). The basic care delivered by dental nurses included dental prophylaxis, oral health education and diet, placement of fillings, and dental extraction of primary teeth (Tsang, 2010). Through the years, the name of dental nurses changed first to dental therapists and subsequently oral health therapists. The scope of practice also changed and now the work of oral health therapists includes the assessment, diagnosis, management, treatment, and a strong focus on prevention of dental disease (Dental Council of New Zealand, 2021).

Despite the SDS changing, there are still facing challenges in managing inequalities in oral health, particularly among Māori and Pacific children (Moffat et al., 2017). Therefore, in 2006, the SDS was restructured, changing its name from SDS to a Community Oral Health Service (COHS) with a strong focus on prevention and treatment (Nash et al., 2014). However, despite this focus, oral health inequalities persist (Moffat et al., 2017) due to issues mentioned previously (place, time, planning, organisation, and financial cost). The focus of traditional oral health promotion in schools has relied on the skills of health professionals or health teachers. However, we live in a digital era where children can participate as co-researchers and co-designers of their educational games with the possibility of incorporating the Internet. Nevertheless, the potential of using children's curiosity and creativity as prosumers and users of the Internet has not been explored.

2.5 Oral Health Promotion in New Zealand

In 2008, the Ministry of Health created a toolkit—Promoting Oral Health. The toolkit describes the process needed to design effective oral health promotion programmes with a logic model proposed by the Ministry of Health (2006) two years earlier. The objective of the toolkit was to guide oral health promoters in planning and evaluating oral health

programmes implemented in New Zealand (Ministry of Health, 2008). Interestingly, the toolkit does not mention the inclusion of children in the planning of oral health programmes, apart from an example given of the Ottawa Charter in action where children are mentioned as being part of the consultation for community action. Children, however, are mentioned in the toolkit as being the targeted population. In 2015, the Health Promotion Agency (HPA), published a report about consultation with stakeholders taking part in the Ministry of Health's initiative to promote and improve oral health using toothbrushes and toothpaste with pre-school children (Health Promotion Agency, 2015). The report highlights how a national oral health promotion initiative may be designed to promote and improve oral health in pre-school children and their families through toothbrushing and early enrolment with the COHS (Health Promotion Agency, 2015).

Healthy Smile, Healthy Child is another guide prepared and published by the New Zealand Dental Association (2008). The guide provides New Zealand Well Child Tamariki Ora health providers with training, information, and understanding about the prevention of ECC (New Zealand Dental Association, 2008). However, there is no mention of how the Ministry of Health funds or supports oral health promotion in schools apart from oral health resources available to health facilitators through the website. These resources are pamphlets, posters, videos, and other valuable resources in different languages to promote oral health for children and adolescents (Ministry of Health, 2021b); for instance, in 2016, a tooth fairy video clip was developed. The tooth fairy (a Pacific tooth fairy) visits a Pacific parent and teaches them how to brush their child's teeth. The aim of the campaign was to target Māori and Pacific communities (Health Promotion Agency, 2022b).

Non-governmental agencies like the HPA, in partnership with the New Zealand Dental Association, advises and provides resources to schools to encourage students to maintain healthy lives (Health Promotion Agency, 2022a; Te Kete Ipurangi, 2022a). However, the resources available from the HPA are limited to nutritional advice such as the effects of the consumption of sugary drinks. These resources are in the form of posters, pamphlets, and talk cards that can be used by educators to support teaching in health promotion. The sugary drinks resources focus primarily on obesity; dental caries is simply mentioned as a result of the consumption of sugary drinks (Te Kete Ipurangi, 2022a).

There is no information available on the Ministry of Education's website to inform how oral health promotion is supported by governmental agencies or by the Ministry of Education apart from the operational funding that schools receive from the government (Ministry of Education, 2022). School boards are responsible for management of the operational funds they receive, which they need to prioritise for their use for teaching in

other areas as stated by the New Zealand Curriculum (Ministry of Education, 2021a). However, oral health promotion is briefly mentioned in the key area of learning about body care in the Health and Physical Education learning area of the New Zealand Curriculum (Ministry of Education, 2015).

Despite guidelines from the Ministry of Social Development (2003) about how to engage children in the decision-making process, it appears that government and non-government institutions do not consider the inclusion of children in the development of oral health programmes. This may be due to the belief that children are not equal stakeholders and do not have the capacity to make rational choices about their health because of their age, or they are not considered as socially active members of the community or society (Groundwater-Smith et al., 2015; Horgan, 2017; Loveridge, 2010; Melonio & Gennari, 2013). Other barriers to engaging children in research include the belief that it is not appropriate for children to participate in decision-making processes or that researchers cannot recognise and accept children's views, language, and cultural backgrounds (Ministry of Social Development, 2003). Furthermore, in the context of the digital age, there has been poor uptake so far of the tools available for collaborative and creative design of oral health promotion.

If the current ideology in oral health is about prevention, then alternative approaches outside the traditional institutional health programmes, that include children as advisors, designers, and evaluators, must be explored. The rise of digital technology, Internet accessibility, children as prosumers, and serious games offers new directions and participation options (Conn et al., 2017) to challenge traditional oral health programme developers and policy makers to work alongside children.

2.6 Children as Co-Designers

Co-design is a term that evolved from the participatory design movement in the early 1970s and co-creation (Melonio & Gennari, 2013; Stedjeberg, 2017). Co-design is an approach that involves stakeholders in the design process with the intention of getting different opinions and solutions about a designed product that meets the needs and is able to be used (Melonio & Gennari, 2013).

Children are enthusiastic people who are gifted with creativity and have unconventional opinions on all matters (Melonio & Gennari, 2013). Children in today's society are exposed to digital technology at an early age and they develop the ability to use technology in different ways to express their ideas (Melonio & Gennari, 2013). Children are interactive, mobile, and have a natural instinct in socialising, with the potential to be

partners of co-designing (Melonio & Gennari, 2013). Children are valuable participants in decision making as they have knowledge that is only experienced by them. That is, they are the experts of their own experience about how they see the world that surrounds them (Stedjeberg, 2017). Children are great communicators and have the ability to express themselves in different ways and contribute to decisions about matters relevant to their well-being (Stedjeberg, 2017).

Traditionally, adult designers of new policies, technology, teaching programmes, and other matters that affect children, make decisions for what they believe is in the best interest of children rather than asking children directly (Druin, 2002). This is partly because children are considered to be unable to verbalise their thoughts and feelings. Another important reason is the power structure between adults and children, in which adults have the knowledge and are the producers, while children are the learners and the consumers of what adults do (Druin, 2002; Melonio & Gennari, 2013; Stedjeberg, 2017). These relationships put children in a position where their voices and opinions are not considered (Druin, 2002).

Appropriate co-design methods can be used and adopted to allow children to share their experiences and express their opinions (Stedjeberg, 2017). The fundamental principle behind a co-design session is the collaboration between children and adults in the design process for a common outcome (Melonio & Gennari, 2013). Children can be included in a design process as the user, tester, informant, and design partner (Druin, 2002). This co-design approach with children can be implemented in a school environment where children are encouraged to create a toothbrushing game based on their creativity, opinions, and experience about oral health promotion.

2.7 The Potential of Games to Support Learning

Games in education have an important role as they promote motivation, engagement, interaction, and collaboration with their peers. They are used in education to support teaching and promote skills development by following rules, interacting with peers, critical thinking, and creativity (Zirawaga et al., 2017). Game-based learning (GBL) refers to teaching practices involving games. The use of this practice may involve non-digital or digital games, games designed for teaching purposes, or games that have been modified for teaching and learning purposes (Bolstad & McDowall, 2019).

Traditional games and board games are a type of GBL that can be used in the classroom to teach students to engage in and develop problem solving and social skills (Bolstad & McDowall, 2019). Apart from providing entertainment and leisure, the benefit of applying

GBL in teaching is that it promotes engagement, motivation, cohesion, collaboration, and participation among the students (Bolstad & McDowall, 2019). This aspect of learning is essential for children to support their game analysis skills so they can create serious games that do not necessarily need to include digital technology, if this is not available or accessible in their communities (Bolstad & McDowall, 2019).

The co-design of games could use material resources available in the classroom such as paper, carboard, colouring pencils, markers, paint, etc. Alternatively, children can bring different types of materials they can think of and use their own materials for the game. A school teacher, for example, can encourage children to play board games, card games, skittles, pick up sticks, and knuckle bone games to learn about games before children created their own game (Te Kete Ipurangi, n.d.). Then the teacher may provide the students with materials to create a game with pieces of wood, cards, play dough (to make models), modelling clay (to make dice and counters) to encourage creativity in the design of board games for rainy days (Te Kete Ipurangi, n.d.). Apart from learning to work in groups and learning about games, it also shows children how to have fun on rainy days when they cannot go outside to play.

2.8 Games for Health

Games have the ability to engage players, they are recreational, and they have the benefit of promoting children's development (Baranowski et al., 2016). Games are a form of play and have objectives, challenges, and rules that allow players to either win or lose (Baranowski et al., 2016). In general, the aim of a game is to provide a positive experience that encourages the player to continue playing the game (Baranowski et al., 2016).

Games for health are games designed with the purpose of, apart from entertainment, promoting health by increasing the user's knowledge and to change behaviours about their well-being (Baranowski et al., 2016). Serious games are a type of digital game (Caserman et al., 2020). These games are a type of serious game and are accessible to most people as they are built into computers, Web browsers, game consoles, and smartphones (Baranowski et al., 2016). A characteristic of serious games is that they promote knowledge through their pedagogical and motivational components as fundamental features of serious games, and place the user as the centre of the game that allows continued interaction, repetition, and feedback of the performance (Drummond et al., 2017; Rodrigues et al., 2020); thus promoting positive behaviour change to the user's health (Baranowski et al., 2016; Caserman et al., 2020).

Games for health have been designed in different health disciplines with the intention to promote disease prevention (Baranowski et al., 2016). There are five types of games for health. Four of these are games created to increase health knowledge, change health behaviours, change behaviour by incorporating behaviour change in the game, and influence health precursors. The last type are games designed to educate and train health professionals in the delivery of quality care (Baranowski et al., 2016; Rodrigues et al., 2020; Wattanasoontorn et al., 2013). A game has the following components: rules, challenges, interaction, and objectives. There are two types of objectives: 1) explicit objectives, which refers to the purpose of pure entertainment; and 2) implicit objectives which refers to the increase of skills, abilities, knowledge, and experience. The implicit objective in a game is what makes the game a serious game (Baranowski et al., 2016).

As previously indicated, serious games have been developed and implemented in different health disciplines for medical conditions, psychiatric conditions, rehabilitation, health related social issues, public health, wellness, interpersonal skills, medical education, paediatric cancer patients and survivors (Baranowski et al., 2016; Caserman et al., 2020). Despite this development, there is limited research into serious games in dentistry and, in particular, in oral health promotion (Zaror et al., 2021). A review conducted by Rodrigues et al. (2020), about the use of serious games to educate children in oral hygiene found that, despite digital games being designed in this field, those that are designed with the intention to educate users is limited (Rodrigues et al., 2020).

In a review of serious games used in oral health, Zaror et al. (2021) found that some serious games to promote oral health were as effective as conventional methods in teaching oral health. However, the authors concluded that little is known about the effectiveness of existing serious games in oral health and the teaching aspect of these games (Sipiyaruk et al., 2018; Zaror et al., 2021). The authors suggested that for a serious game to be considered as a learning tool to promote health, aspects such as game design, enjoyment, user's interaction and satisfaction, learning outcomes, pedagogical components, and applicability to real situations should be evaluated before their implementation (Zaror et al., 2021).

There are limited numbers of publications in oral health where serious games have been implemented to improve children's oral health, particularly with toothbrushing. However, to my knowledge, of the serious games I identified for this literature review, none were designed by children, nor was their participation in the design of these serious games taken into consideration. This opens an opportunity for further research in creating a space and opportunities for children to co-design their own toothbrushing game to promote and improve their oral health.

2.9 Games and Serious Games in Oral Health

Games for health promote health and well-being by increasing the user's knowledge to change their behaviour (Baranowski et al., 2016). As a result, interest in the applicability of games as serious games to promote health is increasing. However, limited research has been conducted on the applicability of serious games in oral health, particularly with toothbrushing (Zaror et al., 2021). Furthermore, little to no evidence suggests that children are consulted or participate in co-designing serious games for oral health or oral health promotion activities.

Despite that some digital games have been designed to promote oral health in children, Rodrigues et al. (2020), Sipiyaruk et al. (2018), and Zaror et al. (2021) identified that some games do not meet the requirements of serious games. Serious games are digital games that promote knowledge through pedagogical and motivational features (Caserman et al., 2020). Some of the identified serious games, for example, have limited teaching and educational focus and their effectiveness is comparable to any other conventional teaching methods in oral health, such as not being able to offer interactive learning features to generate knowledge, encourage the users to improve their knowledge, or promote motivation for learning (Sipiyaruk et al., 2018; Zaror et al., 2021). Another important fact about the use of these serious games is the minimal research conducted to assess their effectiveness in promoting oral health. The enjoyment level is achieved by the encouragement of the user to engage in achieving the objectives (challenges) of the game until they have met success (game satisfaction). The repetition of playing the game encourages motivation and stimulates the brain to learn, gain knowledge, and develop skills to overcome the challenges of the game (Zaror et al., 2021).

2.10 Healthy Harold Programme

An alternative approach to delivering oral health promotion to children is to educate and inspire children to get to know their bodies so they can make positive changes to their lifestyle. One approach is the use of the Healthy Harold Programme (HHP), from Life Education Trust, to support the teaching of health and well-being education. Life Education Trust NZ is a not for profit New Zealand charity that supports schools with different topics to enhance teaching, so children learn to make positive choices (Life Education Trust, 2021b).

The HHP uses a giraffe called Harold as a mascot that supports the teaching with the educator and encourages children to participate in educational activities in the classroom. The HHP focuses on the teaching of various topics in health and well-being using interactive programmes. The programme supports the teaching, so children gain skills in understanding about health and how this contributes to their well-being by making healthy choices, how their body functions, and how to develop self-esteem. The topics offered by the HHP are food and nutrition, human biology, relationships, and communities (Life Education Trust, 2021b). The contents of topics about food and nutrition focus on the following:

- Where does our food come from? Students learn the sources of food, how to balance a diet and how food relates to their nutrition.
- How can I tell if food is healthy or not? Students learn the importance of reading food labels, nutritional value, and how they can make healthy choices.
- Why do we need to eat a variety of food? Students learn about what a healthy diet is and gain skills in identifying healthy food.
- Why is it important to know about the food we eat? Students learn about what food does to their bodies and how it benefits or affects their health.
- Why is important to eat food? Students learn the importance of food and how it is essential for body growth and development.
- What happens to our bodies when we eat food? Students learn about the digestive system and how food is essential for everyday needs.

The HHP also contains a topic about hygiene in general. Within this content, students learn the importance of looking after themselves and their bodies. Students learn the importance of hand washing, headlice, body hygiene, oral hygiene, and sneezing (Life Education Trust, 2021a).

Within oral hygiene, students learn to:

- Brush teeth twice a day,
- Before going to sleep,
- After breakfast,
- Use a pea sized amount of toothpaste,
- Use a toothbrush with soft bristles and brushing
- Brush teeth and gums at 45-degree angle
- Include all teeth surfaces when brushing them. Brush gently and thoroughly back and forth in short tooth-wide strokes

One of the seven key learning areas in the New Zealand Curriculum is about body care with emphasis on personal body care and, in particular, personal hygiene, including teeth (Ministry of Education, 1999). Therefore, the concept of oral health promotion to maintain good oral health care to prevent dental caries fits well in this area as toothbrushing is an important aspect of people's personal health.

The alternative approach to the implementation of toothbrushing programmes in schools, with all the difficulties they involve, is a strong focus on the promotion of oral health delivery in schools during the teaching of the key learning of body care about personal hygiene, including teeth (Ministry of Education, 1999). Oral health promotion could be well supported by stakeholders, such as the HHP, and with the creation of a space for children to co-design their own toothbrushing game to self-encourage toothbrushing. In order to co-design a toothbrushing game, the students need to learn the basic terminology and concepts of body care, which is when health-related topics such as food and nutrition and oral hygiene could be well supported by the HHP.

Understanding what types of food contribute to dental caries, the nutritional value of this type of food, and how to look after their own personal hygiene (such as toothbrushing) provides opportunities for children to co-design their toothbrushing game that ideally leads to oral health promotion.

2.11 A Brief History of the Internet

The Internet is a communication tool that allows people to communicate with each other using a computer or electronic devices like smartphones (Melendez, 2019). It is considered the most powerful communication tools, with other forms of communication, being the radio, telegraph, telephone, and television. The Internet has become an essential and irreplaceable way of communication in our daily lives (Dolunay et al., 2017). Thanks to the creation of the World Wide Web (the Web), the Internet has allowed people to communicate with each other by using tools for social networking, instant messaging, conversations using videoconferencing programmes, and even phone calling (Melendez, 2019).

The Internet was developed in 1960 from a research project called Arpanet by the Defence Advanced Research Project Agency, an agency managed by the Pentagon. At that time, computers were used in offices, universities, organisations, and official departments. The Agency realised that computers were increasingly used in these spaces and across the world and that they could be used more efficiently by sharing data with each other from long distances (Melendez, 2019).

In the 1970s, emails started to be sent between computers and from long distances. This was the beginning of a completely new way of communication, online communication (Melendez, 2019). By the 1980s, the transmission control protocol (TCP), one of the basic standard protocols that allow computers to exchange messages through a network, was created (Melendez, 2019; sdxcentral, 2021). Consequently, the creation of the TCP allowed the creation of the User's Net (Usenet) which is an Internet-based network of discussion groups that allowed users to read, write, and share information (Britanica, 2021; Melendez, 2019).

In the 1990s, the European Organisation for Nuclear Research created the hyperlink to help in the building of Web pages. Web browsers like Microsoft's Windows 95, and chat programmes like Yahoo Messenger were created. Emails started to be sent and received widely (Melendez, 2019). The chat programmes developed in the 1990s have now been replaced by new messaging programmes called Messengers. These new messaging programmes include Facebook, Google, and Apple Messages, and text messaging using cell-phones (Melendez, 2019). These communication tools can now be used in digital devices such as smartphones with more advanced tools than their previous programmes (Melendez, 2019). A smartphone is a wireless electronic portable digital device that combines features of a phone with computer functions (Chmielarz, 2020).

Currently, people access the Web through Web browsers. Web browsers are a type of software application that is integrated in devices such as desktops, laptops, tablets, and smartphones to access information. The most common and popular Web browsers are Google Chrome, Mozilla Firefox, and Apple Safari. Through the Web, people have access to live radio, music, TV programmes, and keeping in touch with what is happening in other countries, and with family and friends (Melendez, 2019).

2.12 From Web 1.0 to Web 4.0

Web 1.0 was developed in 1994 after the creation of the World Wide Web (www) (Lupton, 2014) and refers to the first stage of the creation of the Internet with Web pages and hyperlinks (Melendez, 2019). Web 1.0 started as a Read Only Web. It is also referred to as the Syntactic Web, as data were static, and the user was unable to interact with the content of the information or communicate back to the producer (Rajiv & Manohar, 2011; Techopedia, 2019).

From 2004, the term Web 2.0 or Social Web appeared and was used to describe a Read-Write Web allowing users to interact with others sharing information and to influence the Web (Lupton, 2014; Rajiv & Manohar, 2011; Techopedia, 2019). Web 2.0 allowed users

to consume digital content and co-create or produce new information that could be shared with other users, as the prosumers of digital technology (Aldwell et al., 2018; Lupton, 2014). The main characteristic of Web 2.0 is that it provided sophisticated tools used by the consumer to produce new information that could be disseminated through social media like Facebook, YouTube, Flickr, Twitter, and others (Aldwell et al., 2018).

Web 3.0 or the Semantic Web appeared in 2007 and is classified as the Read-Write-Execute (Madurai, 2018) which refers to the evolution of the Web or Web evolution (Rajiv & Manohar, 2011). It is the Web we use today, the intelligent Web. It has great searching tools to navigate the Web and has the capacity to understand human language (Pandora FMS, 2018). Its main component is what is called artificial intelligence as it allows computers to generate and think new information like humans (Nath & Iswary, 2015). That is, Web 3.0 allows computers to understand Internet data by being able to comprehend the meaning of words without the use of keyboards (NKN, 2020) and generate information rather than humans (Rudman, 2016). One example of this is Apple Siri which uses voice recognition software (NKN, 2020). Another characteristic about Web 3.0 is its mobility, as users are able to access the Internet through portable digital devices and the Cloud (Pandora FMS, 2018). Apple Siri, Google's Cloud API, and Wolfram Alpha are examples of Web 3.0 (Madurai, 2018).

Web 4.0 is still developing, and has not yet been named (Madurai, 2018; Pandora FMS, 2018). One suggested name is the 'Symbiotic Web' as humans and devices will interact in symbiosis allowing computer programs to think and make decisions in searching and content (Nath & Iswary, 2015). It is expected that Web 4.0 will make searching for information much easier than Web 3.0. Search engines will continue to be used but they will be more integrated as virtual assistants. Virtual assistants are software that use voice recognition (e.g., like Apple Siri, Amazon Alexa, Windows Cortana, Telefonica Aurora, Samsung Bixby) (Pandora FMS, 2018). The advancement of technology makes it easier and faster for children to search information and use tools that support the development of their oral health games. The current technology and the arrival of Web 4.0 have great potential to be used by children to promote oral health games to their friends, family, and community using the Internet. These concepts of digital technology development make it possible to consider the applicability of serious games in oral health promotion.

2.13 Internet, Mobile Devices, and Serious Games in the Pacific Region

Developing countries have seen an increase in access to digital technology. The Pacific region, for example, has seen an increase in access to smartphones and the Internet

bringing information, education, and globalisation to the Pacific Islands. It was anticipated that by 2020 the Pacific Islands was to move from 15% of the population (1.7 million individuals) accessing the Internet to a third of the population—an additional 2.4 million people across the Pacific Islands (GSM Association, 2015)—and that the influence and place of the Internet and smartphones would be particularly relevant for children of the Pacific.

Internet and mobile digital devices allow people to access information, play games, and use tools to create and manipulate information. Of these games, serious games are becoming increasingly popular as their main characteristic, apart from having entertainment features, is that they are designed to focus on a particular objective. The main idea about serious games is to focus on learning or training with the view that the learnt knowledge or skills can be applied in real situations (Wattanasoontorn et al., 2013). This characteristic gives serious games the potential to be used, through a mobile application, in different learning fields that include education and health (Payne et al., 2015; Wattanasoontorn et al., 2013).

A mobile application, also called a mobile app or an App, is a computer or software programme used in mobile devices such as smartphones, tables, or other digital devices (Underwood et al., 2015). Apps are small pieces of software with limited functions that are used in games, calculators, or mobile web browsing, and are designed to move away from software integrated in computers (Techopedia, 2021).

The price of mobile devices has decreased, making them available to almost anyone, including children. Mobile Apps, apart from smartphones, can also be used on tablet computers. Therefore, mobile devices help deliver health interventions because of their widespread availability, powerful tools, and portability. People always tend to carry their phones and develop emotional attachments to them. The emotional attachment phones create with users may benefit the promotion of health as mobile devices are accepted more readily than traditional ways of delivering health education, especially to those who have growth up with technology (Underwood et al., 2015).

However, the idea of serious games, and the suggested benefits, goes beyond access to technology to a paradigm which aims to put users or communities at the centre of addressing issues and involving them as creative people in a ‘prosumer’ approach to health and well-being. Prosumers are people who use Web 2.0 technology. They are enthusiastic people and early adopters of ‘connected life’ who engage with Web 2.0 through networks, blogs, videos, podcasts, mobile communication, and Internet-based technologies to enable them to connect with other people whenever and wherever they wish (Gerhardt, 2008).

Children have always shown the need to participate in society and to express themselves. Recently, the need has been expressed through online communication where young people talk about what they think, what concerns them and how they feel—to the extent that they have made room for themselves on the Internet as 'public communicators'. Children, as consumers and producers, are also prosumers with the ability to create digital knowledge with the possibility for it to be used in different ways and to be applied in different fields of education. This process allows children to engage themselves in their own learning and use this knowledge to educate others (Herrero-Diz et al., 2016). Many children enjoy playing games using their mobile devices and developing a game to promote toothbrushing may be an innovative and age-appropriate approach for this research project.

In health, serious games are used to promote interest in training and education, and to assess the performance of the user. For example, serious games are useful in the education and training of health professionals to prevent medical errors or in rehabilitation processes. They help the user to repeat a specific task such as exercising, dancing, or doing fitness (Wattanasoontorn et al., 2013). Many games have been developed in the field of e-health with the intention to promote training and patient care (Wattanasoontorn et al., 2013).

2.14 Exposure to Digital Environment

We live in an era where easy access to information and technology is increasing. Children are exposed to digital technology at an early age and they quickly develop the ability to use computers, smartphones, and other digital devices (Annarumma et al., 2018). The constant use of the Internet has created what Jenkins et al. (2009) called *participatory culture*, as Internet users are actively accessing, creating, and sharing information amongst their friends and communities. A participatory culture is a culture in which people engage with others not just to use the Internet (consumers) but to express their ideas (prosumers). People belonging to this culture are supported by the engagement of members who have more experience and are willing to share, mentor, and support those with less experience (Jenkins et al., 2009). This digital culture provides tools that enable consumers to use existing information to co-create new content based on existing information. Prosumers use appropriation as a method for creating new information by re-using, re-mixing, and communicating directly or indirectly with other users to create new material. Appropriation refers to the re-mixing and re-making of existing material such as pictures, videos, music, and other digital material (Ivashkevich, 2015). Jenkins et al., as cited in Ivashkevich (2015), called these users digital prosumers.

Creating a blog, posting pictures in Facebook, or creating a video in YouTube are examples of members engaging in this participatory culture (Ivashkevich, 2015).

One of the main advantages of the Internet is that it provides tools that enable users to engage and get motivated to search for fast and instant information through portable digital devices anywhere and at any time (Park & Kwon, 2018). The Internet then has become our main mode of communicating and networking, especially among youth as they spend a considerable amount of time searching for information and socialising through social media (Park & Kwon, 2018). Despite the Internet being considered our principal source of obtaining instant information, little is known about how the youth use the Internet to search for health care services (Park & Kwon, 2018). Access to health care information, or any other type of information through the Internet, based on socioeconomic status, significantly impacts the well-being of the users. This is what is called the *digital divide*. The digital divide is the gap between people who benefit from the digital era by accessing the Internet to obtain information relevant to their health and those who do not. This gap puts those who do not at a disadvantage and influences how the disadvantaged people experience health and illness (Park & Kwon, 2018).

2.15 The Role of Prosumers

A prosumer is a person or consumer who is highly motivated in the use of technology to innovate creativity with the objective of benefiting other users of that technology, themselves, and their communities (du Plessis, 2018). The term prosumer was proposed by Alvin Toffler in 1980 to describe an imaginary group of new consumers who directly participate in the design of their favourite product or services (Ivashkevich, 2015).

Prosumers are heavy technology users, using laptops and desk computers or any other small digital devices such as smartphones as these are easily carried and used at any time. These devices have the accessibility to have different screen applications which allow them to work on different projects at the same time. These electronic devices also allow people to communicate with friends and family and use the technology available to manage their personal and professional lives. The mobile phone has become one of the most used electronic devices for communication and use of other complex applications (Gerhardt, 2008).

Prosumers are great users of the Internet, and they like to use it anywhere—from home to public areas. They like to access information at all times and to communicate with friends and family or to entertain themselves by using games, listening to music, watching videos, television, and other mass entertainment (Gerhardt, 2008). There is a

strong link between the change to an internet-based society, children as digital natives, and the opportunities offered by the Internet for everyone including children to be both consumers of content on the Internet and also producers of content. It is this combination of possibilities which can create a space for children to be prosumers, designers, and co-creators.

2.16 Chapter Summary

This chapter started by considering the role of critical theory in challenging power structures about children as the theoretical approach for this review. This tradition is evident in research where power and control are imposed, particularly when conducting research with children. In normative or objectivist research, there is a tendency to believe that children's social, cultural, and political contexts are not important. Therefore, there is an exclusion of children participating in research, especially in oral health.

Children are creative and interactive and using technology have the potential to be the primary researchers in oral health. Technology and the digital era continue shaping the way children, and people generally, access information and communicate with others. Children are significant users of the Internet, and this offers great opportunities for them to co-design their toothbrushing game, as a serious game, and to share it with others through digital social platforms. There is considerable potential for children to become prosumers of oral health.

The analysis of this literature has been made through the lens of empirical information about how critical theory, research, the Internet, and digital technology offer the young generation opportunity to participate in co-designing their own programmes or serious games based on their age, beliefs, and interests. Technology may not be accessible to children or teachers; however, considering a lack to access or lack of digital resources in a classroom or community, should not be a determining factor preventing children from developing serious games using non-digital resources.

Chapter 3 Methodology

3.1 Introduction

This chapter discusses the methodology used in this research to answer the question: *How can adult facilitators create a space for children to co-design a toothbrushing game to promote oral health?*

According to Crotty (1989), four essential elements must be considered when doing research. Epistemology, as the study of knowledge; theoretical perspective, as the way the world is seen and how it is perceived; the methodology, as the strategy used to explain the methods; and methods, as the techniques implemented to obtain data. Based on these elements the epistemological approach of subjectivism is applied in this project; critical theory supports the theoretical perspective; PAR is the methodology implemented; and workshop is the method used to collect the data (Figure 1).

Figure 1

The Paradigm that Supports this Research (adapted from Crotty, 1998).

Subjectivism is an epistemological approach that describes that the world is accessible through the lens of experience (Bradbury, 2015). Bradbury (2015) stated that experience is subjective, and unfolding the experience is central to the research using collaborative inquiry. Collaborative inquiry refers to working with people, in this case with children, rather than on people. Applying collaborative inquiry, in this thesis children were involved

as co-researchers using PAR (Heron & Reason, 2005). This approach allows researchers to focus on children's voices and opinions.

The critical theory approach challenges adults to empower children as co-researchers through the methodological approach of PAR. This approach involves listening to children's voices and opinions about how a toothbrushing game can be used to promote oral health. This research explored the ideas and creativity of adult facilitators in creating a space for children to co-design a toothbrushing game. PAR offers excellent opportunities to partner creatively with children (Groundwater-Smith et al., 2015).

PAR intends to generate knowledge through the participation and action of community members (MacDonald, 2012). The community and the academic researcher work together as co-researchers to identify a problem affecting their community and organise themselves to find a solution that can be implemented, supported, and evaluated by them (Bennett, 2019; Lawson et al., 2015; Morales, 2016). The difference between traditional research and PAR is that in the former, people who are not part of the community lead the research. In contrast, in PAR, the research is conducted by those who belong to the community with the academic researcher. People experiencing the difficulties of problems in their community actively collaborate with the academic researcher to find solutions to the problem (Morales, 2016).

PAR, underpinned by critical theory, seeks to challenge power imbalances that exist between people (e.g., between children and oral health policy makers) when conducting research (Kindon et al., 2007; Shamrova & Cummings, 2017). Children, as members of society, can contribute and participate in social changes, specifically in this study on oral health promotion practices and policies. Indeed, children have the same rights as other people in a community, including the right to express their voice, opinions, and points of view as stipulated by Article 12 of the UNCRC (United Nations, 1989).

In conducting research with children, adults hold the power to control the study. Usually, they design the study, collect data, or develop the research questions that are important to them. In this case, children have a minority status in this group, allowing the power of adults, their opinions, and their voices to influence children's views, voices, and knowledge. Thus, the adults' perspectives about the research stand out, not the children's whose perspectives are under-represented or not included in the research (Australian Human Rights Commission, 2010; Groundwater-Smith et al., 2015). For these reasons, PAR with children is proposed as an appropriate approach to challenging power inequalities between adults and children. Ideally, children are the advocates for games that support their oral health (Shamrova & Cummings, 2017).

PAR with children uses methods that enable children to speak freely about themselves and their lives. These interactive methods include puppetry, drawing, storytelling, roleplay, and mapmaking as the basis for group collaboration, discussion, and analysis. However, the main characteristic of participatory research with children is not the methods used but the social relationship that leads to the coproduction of knowledge (Horgan, 2017; Shamrova & Cummings, 2017).

In this research, children are considered the active participants and co-design partners as they are the subjects rather than the objects (Groundwater-Smith et al., 2015; Horgan, 2017; Shamrova & Cummings, 2017; Smith et al., 1997). Based on the high levels of dental caries experienced by children, this research explored the creation of a space for children using PAR to develop a toothbrushing game as a serious game to encourage daily toothbrushing in support of their oral health.

3.2 Study Design

The rationale for this study design is that children belong to a learning community in which they learn to think critically about what positive changes they can contribute to improving their well-being and that of their communities (Ministry of Education, 2015). Identifying aspects that impact their oral health, such as consuming food with high sugar content and dental caries, promotes the development of their skills to implement changes. However, undertaking PAR with children is not easy as researchers will always hold the power to guide and control the process (Shier, 2001). Children's participation in research can be identified through a five levels of participation model representing different degrees of partnership. The model is a tool used to reflect on the degree to which a study achieves a high level of partnership and is based on the ladder of participation from 'The right to play and children's participation' by Roger Hart, in The Article 31 Action Pack, published by PLAY TRAIN, 1995. This is an adaptation of Arnstein's (1969) "Eight rungs on the ladder of citizen participation" (Arnstein, 1969; Shier, 2001, p. 109). The five levels of participation model is proposed by Shier (2001) to enhance children's participation in decision-making. These are:

Level 1. Listening to children: At this level, the adults hear children's views with care and attention.

Level 2. Supporting children's views: This step refers to the adults' commitment to supporting children in expressing their views.

Level 3. Considering children's views: This does not mean that every idea must be considered in decision-making.

Level 4. Involving children in the decision-making process: Children are actively involved when decisions are made. At this point, some of the children's views are considered for this process.

Level 5. Sharing power and responsibilities with children in decision-making: This level requires adults to commit themselves to sharing their power with children so both parties can make decisions (Shier, 2001). The decision to share the power should be based on risks and benefits, and both children and adults are responsible for the consequences of the outcome (Shier, 2001; Smith et al., 1997).

Children are vulnerable to being manipulated by adults, as in most cases adults make choices and decisions for children based on what is best for them from the adults' perspective (Stedjeberg, 2017). One place where PAR can be used with children is in a school or educational setting (Shier, 2001). However, schools and other educational settings are adult-controlled environments as school authority is based on teachers' codes of practice where there is little space to promote creativity based on children's voices (Berry, 2002). It depends on schools and teachers providing opportunities and freedom for children to participate in co-design activities (Shier, 2001; Stedjeberg, 2017).

A participatory approach is also supported by the New Zealand Curriculum as it has a set of values that focus on encouraging students (children) in innovation, inquiry, curiosity, community, and participation (Ministry of Education, 2015). Implementing these values with the PAR approach strongly encourages students to develop their skills in critical thinking, creativity, and reflection about the common good for them and their communities. The set of values from the New Zealand Curriculum and the access to new digital tools and technology have the potential for schools and teachers to look at new ways to provide children with a space to be researchers and co-designers. Teachers, in this case, could apply the five levels of participation model and participate with children in conducting research and sharing their power in decision making (Bennett, 2019; Shier, 2001).

Serious games are activities that have an educational purpose as they have a pedagogical component that allows the user to gain knowledge about a specific topic to change behaviours (Caserman et al., 2020; Drummond et al., 2017; Rodrigues et al., 2020). Serious games place the user at the centre of the game, allowing continued interaction, repetition, and feedback from the user (Drummond et al., 2017; Rodrigues et al., 2020). The literature on the use of serious games in health is increasing. However, there seems to be limited research on the applicability of serious games in oral health.

In particular, there appears to be a gap in working with children to co-design their serious games. Thus, the potential to explore this area in which children are the researchers using PAR to co-design their serious games in oral health.

3.3 Method

Focus groups are group discussions where the main emphasis is on a specific topic encouraging participants to engage and share their experiences and opinions in an environment that allows free speech (Krol et al., 2014). This method allows people to participate and communicate with each other in a group environment (Davis, 2016). When working with children, focus groups promote strong engagement with their peers in a dynamic way that would not be the same if the conversation was in a one-to-one format (Horgan, 2017). Focus groups enable the researcher to observe how children interact, how they speak, the language they use, and how their ideas influence other participants in the group. Focus groups promote discussions that perhaps were not even contemplated by the researcher, thus creating a rich source of knowledge, ideas, and information (Davis, 2016). For the purpose of this research, the term 'workshop' will be used instead of focus groups as the process to obtain the data was more than a focus group activity. The fundamental principles of focus group approach support the workshop activities. The methods used in workshops with children to collect data are extensive: interviews, visual aids, brainstorming, drawing, mapping, role play, drama, and social media, to mention some examples (Groundwater-Smith et al., 2015).

Appropriate research methods create an environment where trust between researchers and participants is promoted. A study can include various methods, but these methods or tools must be consistent with the chosen methodology (Groundwater-Smith et al., 2015). I conducted workshop activities with adult facilitators to promote discussion and participation and share their experiences and opinions about creating a space for children to co-design their toothbrushing game. The workshop aimed to explore future applications of working with children in co-designing activities for oral health promotion. The workshops promoted a creative and enjoyable environment, where adult facilitators discussed, exchanged, and developed ideas to produce new knowledge in this field (Horgan, 2017). A mix of visual and activity-based methods was used for this purpose, such as word writing, drawings, mind maps, and digital devices, as suggested by Groundwater-Smith et al. (2015).

Based on the findings, I will apply critical theory principles by encouraging children to participate and contribute to research using PAR. Including children in research eliminates the power differences between adults and children when conducting research.

3.4 Recruitment

The adult facilitators for this research project were a mix of young adults from different disciplines and backgrounds interested in working with children. I selected this group of adult facilitators as they span oral health, education, and design. Combining their backgrounds provided for innovation in creating ideas from different perspectives. The diverse views can be applied in settings involving children, such as schools, health promotion sites, gaming clubs, or communities where children play an important role in sports and recreational activities. These ideas have the potential to create a rich environment for children to co-design their toothbrushing games.

The adult facilitators were invited through announcements on the AUT Blackboard and by disseminating the invitation to different disciplines through colleagues via word of mouth and email invitations. Seven adult facilitators volunteered to participate. The adult facilitators included a student from the University of Auckland School of Science and Mathematics who was pursuing a teaching qualification for secondary schools, two graduates from the AUT School of Art and Design with a major in Digital Design and a minor in Motion Capture, and four AUT oral health students from the School of Clinical Sciences, also interested in future teaching in oral health. One oral health student was a former overseas primary school teacher.

3.5 Data Collection

This section discusses how the data were collected. The adult facilitators gathered in a classroom and had the opportunity to introduce themselves, talk about their backgrounds and interests, and get to know each other through an ice breaker activity. I introduced the research project to the adult facilitators using a Microsoft PowerPoint presentation. To facilitate the participants' understanding of the purpose of the workshop activities, I explained the following:

- Purpose and aim of their invitation
- Topic of the research project
- PAR focus

- Dental decay and its consequences in children
- Dental decay in the Pacific Region
- The digital era and children's role as co-designers and prosumers
- The concept of prosumers
- The concept of serious games
- Opportunity to ask questions

The adult facilitators were asked to work in two groups to develop their ideas (data) using PAR. Both groups were composed of a mix of adult facilitators' backgrounds, and in a way that the outcome of their participation activity reflected different views and perspectives. For easy referencing, I named them Group A and Group B. Group A had four adult facilitators: two oral health students and two graduates from the School of Art and Design (Figure 2). Group B had three adult facilitators with two oral health students and one student from the University of Auckland (Figure 3).

Figure 2

Group A with F*our* A*dult* F*acilitators*.

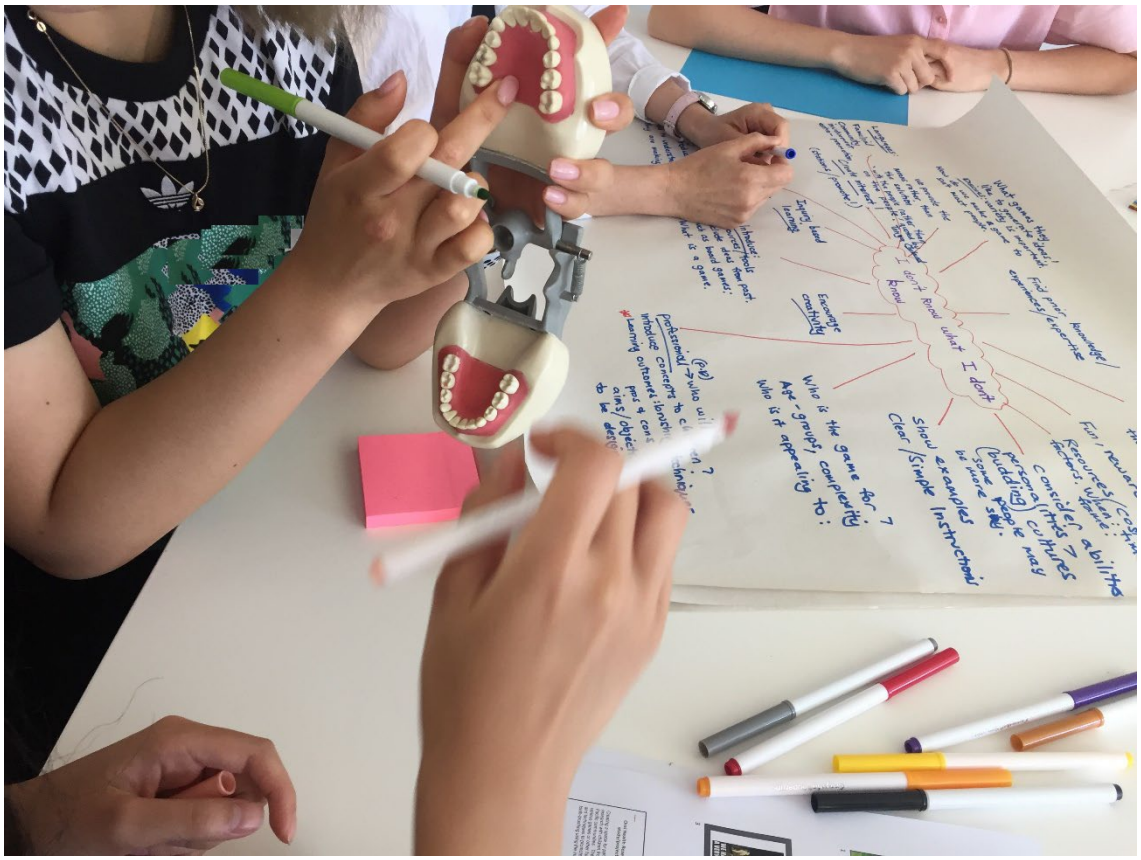
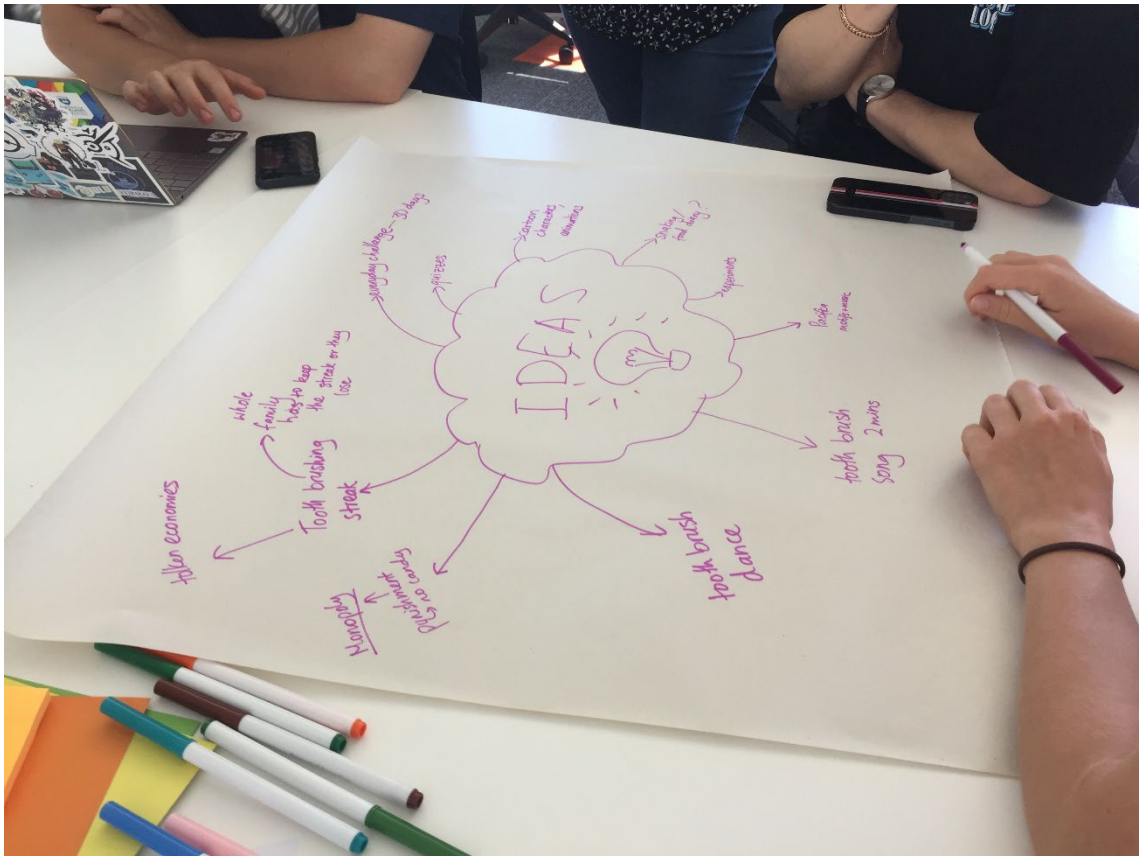


Figure 3

Group B with Three Adult Facilitators.



The adult facilitators had access to stationary resources such as coloured paper, markers, sticky note pads, etc., to express their ideas. They also had access to electronic devices such as iPads, smartphones, and computers. A discussion guide, previously developed, was used to encourage and facilitate the group discussion and to develop creative ideas. The adult facilitators' ideas were collected as a poster that included brainstorming, drawings, and writing using different colours. The group discussion guide was as follows:

- Work in groups.
- Come up with an idea about how you can create space for children to become co-designers in oral health.
- What tools do you think they will need to create a serious game based on your idea?
- How can children (students) create a serious game that can be used in oral health (toothbrushing)?
- Use your creativity, art, knowledge, experience, interests, skills, technology, etc.

- Present your ideas to the rest of the group.
- Discuss the impact of your idea on children to co-design a serious game.

3.6 Brainstorming

Brainstorming was used in the workshops to gather data. Brainstorming is a process in which ideas are generated (ideation) to solve a problem. Brainstorming was the idea of the adult facilitators, who mentioned that this could be used with children in a school setting situation under the direction of the researcher. The brainstorming aimed to gather information about children's understanding of oral health, toothbrushing, a healthy diet, dental caries, and its consequences. The strength of this approach facilitates associations between participants' ideas, thereby broadening the solution space (Dam & Teo, 2019).

3.7 Data Analysis

Data analysis in PAR is an iterative process involving collaboration and critical reflection of the data by the co-researchers (Cahill, 2016). The analysis of the data in PAR should involve the participants to interpret, negotiate, and share power; and to reflect the collaborative nature of the method (Cahill, 2016; Frisby et al., 2005; Kindon et al., 2007; Schubotz, 2020). There are several ways that participants can participate and collaborate in PAR data analysis (Punch, 2014). The academic researcher may analyse data by applying analytical coding and reflecting on this with the participants (Frisby et al., 2005). Then key concepts can be analysed with the participants as a collaborative process that underpins the PAR philosophy (Cahill, 2016).

As an experienced educator, clinical practitioner, and learner in using PAR, I recognise that it is of great value to include data analysis participation and consultation with the adult facilitators. Also, I recognise the value of passing this practical experience to adult facilitators to promote co-design principles with children using PAR as a method of listening to children's voices and advice and to include them in the decision-making process for potential policy change in oral health. However, given the pressure of time and access to the participants, I undertook an initial data analysis by making key points of findings which I then provided for the participants to comment on as part of the collaborative process in PAR (Frisby et al., 2005; Kindon et al., 2007).

I started transcribing the recorded group presentations using the Office Dictation application from Microsoft 365. Office Dictation is a quick and easy way to use speech-to-text-to-author content (Microsoft, 2022). After transcribing the presentations, I compared the transcripts with the voice recording and corrected the 'text' content.

I analysed the group's discussion, poster presentation, and poster content by making an initial comparison of the poster content from each group. I also used my field notes as part of the analysis. The purpose of this comparison was to get familiar with each poster's content and identify similarities among the adult facilitators' ideas. After completing the initial comparison, I analysed each poster separately to identify key concepts relevant to the research question, as suggested by Braun and Clarke (2006), by reading and re-reading several times the content of each poster. I wrote down the adult facilitators' ideas into lists. I created lists of key concepts based on the content of the main ideas using thematic coding as recommended by Braun and Clarke (2006). Thematic coding is the process of grouping text passages or coded texts linked by a common idea. This allows similar ideas to be grouped in categories and into a 'framework' of thematic ideas (Gibbs, 2018).

This process of listing the adult facilitators' key concepts, made it easier to develop the themes. The themes for each poster emerged naturally after comparing the lists of concepts, and I grouped them on a thematic map (Braun & Clarke, 2006). Then, I grouped all similar key concepts from each list under one theme. The purpose of comparing lists and themes was to refine the themes and identify the 'essence' of each theme relevant to answering the research question (Gibbs, 2018). Five child-centred themes emerged from the data analysis.

Theme 1: What is a game
Theme 2: Introducing children to games
Theme 3: Creating a space for children
Theme 4: Children-centred membership
Theme 5: Fun and gainful for children

After I completed the analysis and gave names to the titles of the themes, the final step was the write-up of the thematic analysis as recommended by Braun and Clarke (2006). I also followed Braun and Clarke's six phases of thematic analysis approach to analyse the findings from the workshops; that is, I familiarised myself with the data, generated the initial key codes, searched for themes, reviewed the themes, named the themes, and reported these to the adult facilitators for their opinion and verification.

After conducting data analysis, concepts were grouped into five themes and presented to the adult facilitators for their opinion and feedback. This process guaranteed

consultation with the adult facilitators to ensure that their ideas and concepts were correctly represented under each theme. The gathering of all the adult facilitators was difficult due to personal commitments and the inability to attend invitations to discuss the analysis. Few attempts to gather all the adult facilitators simultaneously were made by email, but this was unsuccessful. Therefore, alternative sessions with the adult facilitators were offered to suit their time. Three sessions were conducted through Microsoft Teams as this was the easiest way to present the results remotely due to COVID-19 restrictions. Microsoft Teams is a Microsoft application for team collaboration in Microsoft 365 that engages people through video to share documents and information (Microsoft, 2021). One of these sessions had three adult facilitators, the second had two adult facilitators, and the last had only one adult facilitator. One adult facilitator was invited by email several times, but there was no response to the invitations; hence, this adult facilitator did not contribute to the final results.

The decision about what to include in the themes was a joint decision between the adult facilitators. I also considered the adult facilitators' voices and opinions regarding the content of the themes (Schubotz, 2020). Consulting with the adult facilitators to verify the themes aligns with the participation process between the primary researcher and the adult facilitators (Schubotz, 2020). This process also complies with the requirements of PAR in terms of participation and consultation and aligns with critical theory (Kindon et al., 2007).

3.8 Ethics

Ethical approval to conduct this research was required as the research used adult facilitators to collect the data. Approval was granted on 11 November 2020 with reference number 19/285 (See Appendix A).

The participants (adult facilitators) were informed of the aim, purpose, benefits, and risks of participating in this research by giving a Participant Information Sheet (See Appendix B). Adult facilitators were also informed that their participation in the research was voluntary, and they could withdraw from the research at any time. A consent form was given to the adult facilitators as required by AUTEC (See Appendix C).

3.9 Chapter Summary

This chapter discussed PAR as the methodology used in the research. PAR is a research methodology in which people from a community experiencing a phenomenon actively

collaborate as primary researchers to find a solution to that phenomenon. Workshops were conducted with seven adult facilitators from different disciplines and backgrounds interested in working with children. The adult facilitators were actively engaged and participated with their groups to explore their ideas, from different perspectives, about creating a space for children using PAR to co-design a toothbrushing game. The diversity of the adult facilitators' backgrounds, their enthusiasm and interest in teaching led to the creation of posters with text, drawings, charts, and rich content that highlighted how to provide children with a space, and a learning environment, to promote co-designing.

The COVID-19 pandemic impacted the direction and conduct of this research. Approval was granted after consulting with AUTEC several times to amend the initial proposal. Recruiting adult facilitators was also a challenge. The amendment to the initial proposal paid off as the workshops with seven adult facilitators and data collection were successful. The result has informed future recommendations of how children can apply what was applied by adults in the workshops, with the future aim to have children guide their co-design process. As the first part of the critical commentary, the next chapter discusses the five themes resulting from the workshops with seven adult facilitators.

Chapter 4 Critical Commentary: Part One

4.1 Introduction

This chapter, and Chapter 5, form the basis of a critical commentary on the findings and their interpretation. Data were collected using workshops with the adult facilitators. Adult facilitators were grouped into Groups A and B and had the opportunity to discuss the creation of space for PAR with children about toothbrushing and making games.

The two groups presented their ideas on a poster. The posters, the adult facilitators' presentations, and field notes were analysed using thematic analysis. The field notes allowed me to reflect and learn from the workshops. They included one hour spent observing the groups collecting information, the social interaction between members of the group, informal conversation, motivation, and enthusiasm towards the discussed themes. The themes were developed from the adult facilitators' creative ideas, and were presented to the adult facilitators for their feedback, as discussed in Chapter 3, section 3.7. Table 1 provides a summary of the main themes developed from the thematic analysis, and the ideas presented in the table are discussed in sections 4.2–4.6. The transcriptions of each group were written in two colours to differentiate them. All transcripts written in **blue font** are the transcripts from Group A, and those written in **green font** are from Group B (see Table 1).

Table 1 *Summary of the main themes*

The Five Themes Associated with Creating a Space for Co-Designing Toothbrushing Games with Children.

Theme 1 (4.2)	Theme 2 (4.3)	Theme 3 (4.4)	Theme 4 (4.5)	Theme 5 (4.6)
What is a game?	**Introducing children to games**	**Creating a space for children**	**Children-centred membership**	**Fun and gainful for children**
▪ 'I don't know what I don't know' concept relating to children's knowledge about oral health and serious games concepts ▪ Smiley face concept ▪ What is a game ▪ Introducing oral health concepts to children ▪ Prior knowledge and experiences ▪ Use ideas from past games - board games, physical games, digital games ▪ Games they like to generate further ideas ▪ Game variety is important ▪ Timeframe (fits everywhere)	▪ Oral health concepts need to be introduced to use in their games ▪ What is an effective game? ▪ Purpose, aims, and objectives of the game ▪ Learning outcomes: More toothbrushing and techniques ▪ Introducing resources, tools, and cost factors ▪ Provide the means of co-design rather than the solution ▪ Work with people rather than on the people	▪ Look at design processes by inviting game specialists ▪ Design eye-catching, colours, heroes, and characters ▪ Session with kids to see which aspects of games they would prefer or like the most ▪ Create your own toothbrushing dance or song ▪ Co-create design colour and characters, myths, legends, and heroes ▪ Provide clear and simple information relating to oral health and developing games	▪ Who is the game for? ▪ Who is the game appealing to? ▪ How do we make a game to suit a diverse group of children? ▪ Considerer children's voices, languages, age groups, complexity, abilities, personalities, and cultures ▪ Children's ideas are respected ▪ Children will have individual design preferences – some may prefer to work alone at times ▪ Community, friends, and family involvement ▪ What effect would the game have on the group if participants were of different ages?	▪ Children creating challenges, missions, quizzes, and rewards ▪ Create a space where children have fun co-designing a game ▪ Promote interests, motivation, and interaction ▪ Allow children to have fun with games to promote interest ▪ Experimenting with games they know to produce new ideas ▪ Children creating rewards to promote advance game levels

The findings show creative ideas representing the views and perspectives of the two groups. Group A discussed and expressed its creative ideas in a well-structured and comprehensive form using coloured sticky notes, colours, texts, and drawings (Figure 4). Group B also presented its creative ideas in a simple form, using paper and markers. Group B presented two posters. Poster 1 (Figure 5) contains the brainstorming ideas, while Poster 2 (Figure 6) addresses the target ideas to share with children. The adult facilitators were guided to focus on their ideas and creativity to develop an environment to create a space for children for PAR and to become co-designers and prosumers in toothbrushing games.

Figure 4

Poster from Group A.

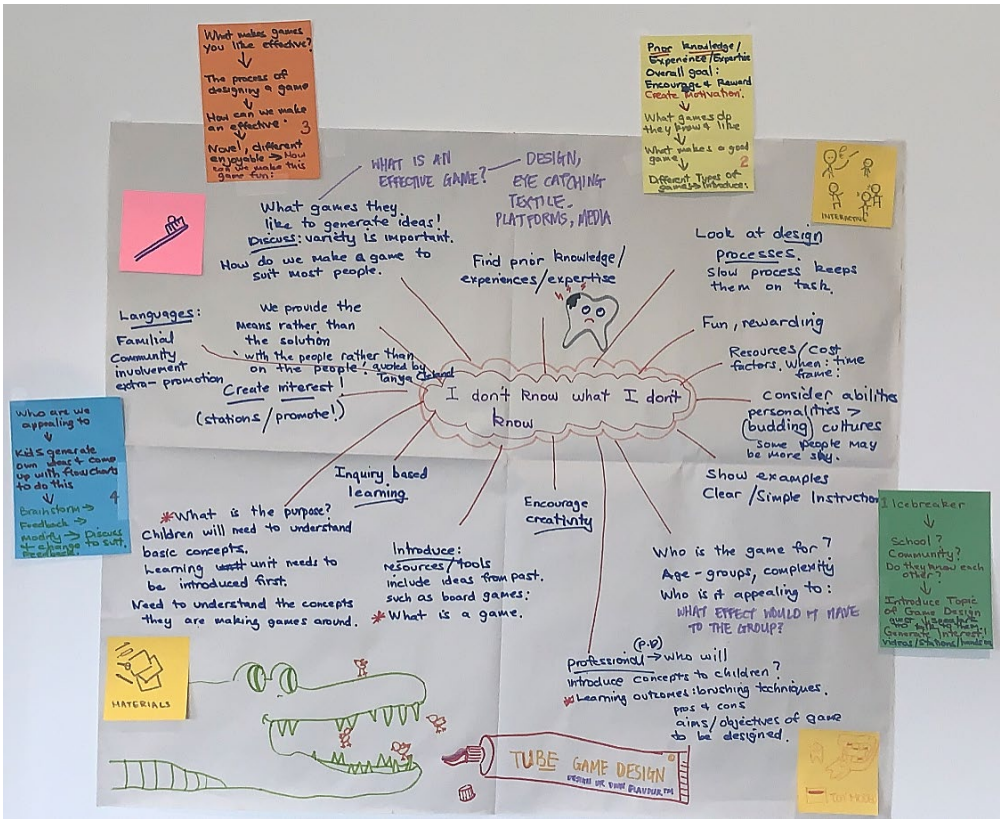


Figure 5

Poster 1 from Group B.

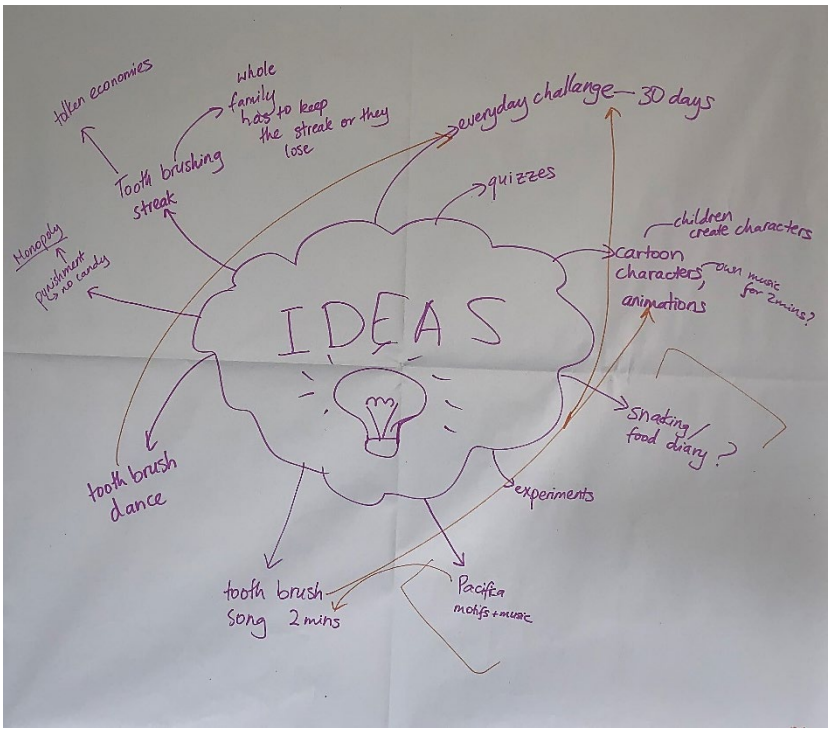
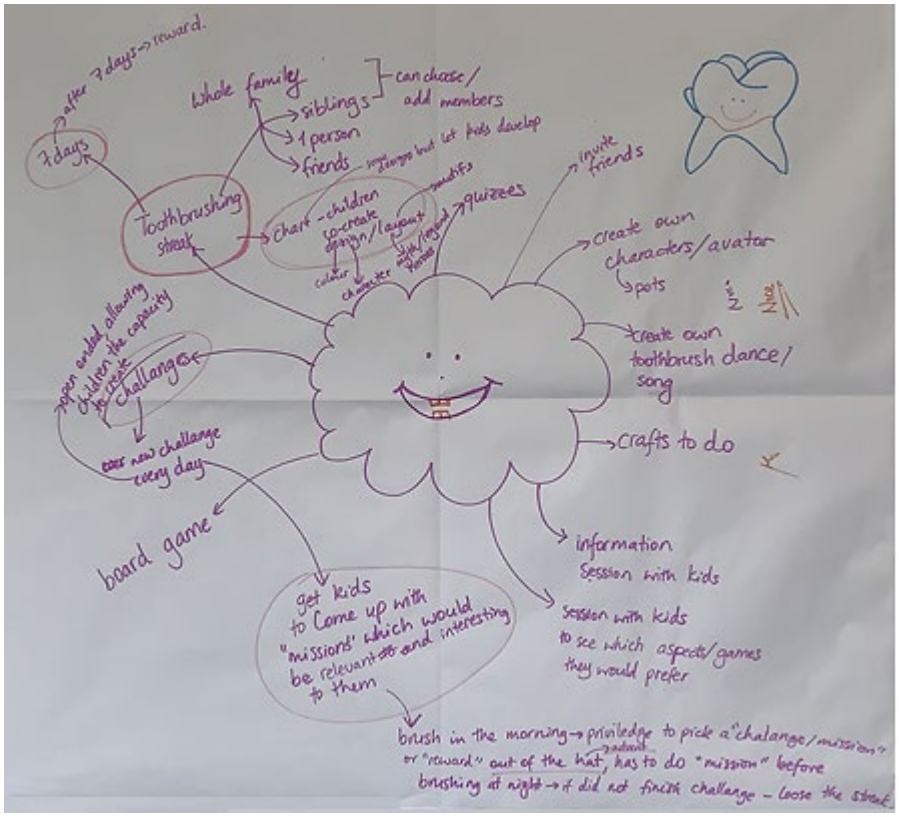


Figure 6

Poster 2 from Group B.



4.2 Theme 1. What is a Game? Adults and Children Learn About Games Together

Both groups expressed their views about introducing the topic to the children through an initial set of guidelines and started their brainstorming of the participatory discussion with an initial phrase. Group A began exploring ideas with the words **'I don't know what I don't know'** at the centre of the poster. The rationale for this phrase was that when creating a space for children to co-design an oral health game, concepts like oral health and game development must first be introduced as children do not know what they do not know.

> *[Group A] Because kids **don't know what they don't know,** we need to basically introduce to them what the concept is that they're designing this game around.*

Group B began their brainstorming by drawing a picture of a cloud with a lightbulb and the written word **IDEAS**. This was the starting point to develop the second poster with a **smiley face** in the centre. The idea was based on the concept that children like to play physical games whether or not they have access to technology to play digital games. Physical games, like sports, are an excellent way to promote social interaction with other children, diversity, and learning from different cultures. They also encourage community collaboration and participation (Bolstad & McDowall, 2019).

> *[Group B] When we thought about the context of Pacific culture, we felt that children are more interested in physical games. Maybe they do not have access to technology as much as we think, so we thought of incorporating physical games*

The 'I don't know what I don't know' and the 'smiley face' concepts were the key points for the groups to develop flow-chart-like ideas. However, as a researcher, I found that these two approaches differed. The adult facilitators had assumptions about children's knowledge. Group A assumed that children have little knowledge or do not know about games or maybe oral health. Group B believed that Pacific children like to play physical games as they may not have access to technology for digital games.

Group A emphasised the importance of introducing basic oral health concepts to children. Pictures of teeth with decay to promote oral health will incentivise the activity using PAR. As an example, the group drew a picture of a tooth with dental caries (Figure 7). Group A suggested that using images with teeth would encourage children to talk freely about what they know or do not know regarding oral health.

[Group A] Because like the tooth with decay …that would be part of …talking about giving the incentive of why you're making the game? what's the outcome? and doing the game would prevent decay, that's the whole point of toothbrushing game, so maybe …having pictures like this and talk about what they know and don't know

Figure 7

Tooth with Decay.

The adult facilitators from Group A proposed creating an environment where children can collaboratively practise designing a game based on previous experience. This opportunity would also allow children to look at the design process and compare their new game's effectiveness, features, and enjoyability with other games.

[Group A] Practise designing a game …is the game effective? Will it be novel? Different? Enjoyable? What makes them good games? What makes them fun?

The adult facilitators from Group B emphasised that since children know about games, they could use this knowledge to generate new ideas. They suggested that like in outdoor games where the activity has been ticked off from a list, a similar concept could be used in the co-design of the toothbrushing game. They could play the toothbrushing game and then tick a box when they have brushed their teeth.

[Group B] We want to mainly re-focus to …kids going outside …doing an activity, coming back, and ticking it off …and then going out and coming back can be represented by brushing their teeth.

4.3 Theme 2. Introducing Children to Games

The adult facilitators from Group A discussed the importance of introducing oral health and game concepts to children. They proposed to allow children to talk about games they already know and to discuss and compare their effectiveness.

[Group A] Maybe then look at some games they like …what makes those games effective? …what makes them good games? what makes them fun?…

*so already keeps them in the process of …maybe working together **with** them to come up with these different ideas …so that they can then …think about the type of game they're going to design.*

Group A emphasised that when creating a space for children to co-design a game, adult facilitators should partner **with** children and empower them in decision-making rather than making decisions for them. The emphasis is that children should be provided with the means rather than giving the solution and working with the people rather than on the people.

[Group A] What surrounds this, I don't know what I don't know, is …also that we are going to help provide the means rather than solution …so we are going to be doing this with the people rather than on the people.

Children may have the accessibility to use the Internet anytime and anywhere. However, they may prefer different game delivery boards; physical and digital may all hold attraction. Hence, the role of the adult facilitators is to create an environment where children can access information, games, or use other resources or tools through their digital devices to modify or change what already exists to create new knowledge or material. Serious games, if designed well, can be widespread; apart from entertainment, they are useful teaching tools to learn new things (Wattanasoontorn et al., 2013). One of the objectives of serious games is to provide unique learning opportunities that can be implemented in their daily lives (Wattanasoontorn et al., 2013).

[Group A] So it already keeps them in the process of …maybe working together with them to come up with these different ideas …so that they can then …think about the type of game they are going to …design.

The adult facilitators from Group B believed that the main objective and purpose of creating a space for children is to promote the co-designing of a toothbrushing game so they can use this as a tool to encourage toothbrushing.

[Group B] The main focus is to get the children to brush their teeth. That is common sense… They are getting our focus in, and we are getting their focus in as well. So …that is the whole purpose.

4.4 Theme 3. Game Co-Design – Creating a Space for Children

The adult facilitators from Group A proposed that teachers or other specialists can introduce concepts of games to motivate children in their co-design. Specialists can talk

to children about games and toothbrushing to understand the importance of these concepts. They even proposed that guest speakers, for example, can bring ideas or game stations so children can try and play with them and get motivated, engaged, have fun, and be interested in game designing.

> *[Group A] Who is going to introduce those concepts to the children …Is going to be teachers? or are we going to have specialised people coming to talk about toothbrushing*

> *[Group A] Maybe that could be through guest speakers or …come up with some ideas of having stations or …things that they could try and play with*

The adult facilitators from Group B emphasised respecting children's game preferences such as 'eye-catching' features, colours, or the use of characters in their game. They suggested that children may want to include their heroes, myths, or legends in the design, so the game reflects group diversity.

> *[Group B] They might like …they might prefer something like …with more like Pacific mythical heroes and might like **minions** more you can have several versions*

Adult facilitators spoke of allowing children to be creative in their own space when co-designing their game, as this can be fun and rewarding for them and keep them motivated and interested in participating. Children may want to vote for their co-designs to select the best game they like.

> *[Group A] Because it keeps kids on task, and it keeps them interested… so… might be rewarding …maybe children could vote at the end on these games and say… who is game they like best?*

The adult facilitators from Group B proposed that children may want to co-design their avatar characters or upload a song to their games.

> *[Group B] Create things like Avatar. You can …upload your own song, which is where software crops into 2 minutes*

4.5 Theme 4. Child-Centred Membership

The findings indicated that it is essential to know more about the children and learn from them. This view of the groups' accord with research recommendations. Horgan (2017) argued that involving children in research can play a crucial role in society by making relevant or critical decisions. This argument supports that children's voices should be

heard as they have this right as with any other community member (United Nations, 1989). Knowing more about where children are from could influence the children's interests and motivation to participate in a project. If children are from different groups or communities, they may have different personalities, interests, and abilities to participate. Children have individual experiences and preferences, and there needs to be a space to allow children to express themselves.

The adult facilitators from Group A proposed to create a space to use an icebreaker activity with the children as this will allow them to talk and get to know each other.

> *[Group A] We need to do something that, …if they don't know each other that maybe an icebreaker because you are going to have a lot of different kids …with a lot of different personalities, interests and abilities.*

The adult facilitators from Group A recognised that it is essential to respect children's voices and abilities to participate. Children are different, and they bring exciting ideas. Other ideas carry a variation that needs to be respected. This concept of respect aligns with PAR and Article 12 of the UNCRC 1989 about respecting children's right to express their views about all matters affecting them. Horgan (2017) emphasised that it is important to empower children and listen to their voices as they have the potential to be great contributors to new knowledge.

> *[Group A] You really need to encourage everybody to respect each other… that is going to be a big thing. Every single person's opinion takes part. As part of that … you probably want to discuss the idea of variety. Variety is important.*

Creating a space where children have the opportunity to discuss and exchange ideas about what aspects of the game they prefer the most was highlighted. Considering children's abilities in participating as some children may be shy and unwilling to participate was also noted. Therefore, allow children to organise themselves so they voluntarily can participate and exchange ideas and opinions.

> *[Group A] To make them think outside the box …allow children to …be creative rather than …otherwise, they just think …oh I like this game …I'll make it like this …You want to consider how you can make it better.*

The adult facilitators from Group A recognised the importance of ensuring that children's ideas are respected, valued, and considered in their co-design of games. This recognition aligns with PAR and Article 12 of the UNCR 1989, which refers to respecting children's views.

[Group A] But you also want them to feel …valued and …that every kid that takes part …that their ideas are going to be valued, and we want them all to take part too.

The adult facilitators from Group A also considered that the languages and cultures of children are essential factors for diversity of ideas, allowing the co-designing of a game that suits a diverse group of children.

[Group A] You might have kids from different backgrounds or have different languages or cultures

The adult facilitators from Group A emphasised the importance of creating a space where children have the opportunity to engage with each other to generate ideas. Children could also take this opportunity to review, assess, and provide feedback about their games to improve their co-design and appeal to other children.

[Group A] Who is the game appealing to? The kids basically generate their ideas, and an important part will be …feedback …from other kids taking part. Then they can modify and discuss their ideas, get feedback and make any changes accordingly.

The adult facilitators from Group A recognised the importance of allowing children to demonstrate their abilities when working together. Some children may be shy to speak, but other group members could speak for them, making this a participatory approach to co-designing their game.

[Group A] We said to consider children's abilities. Some kids are less able to participate. You might want to consider allowing them to bud them up with another kid that is more able. If there is someone shy then they will talk to the kid next to them …and they can consider their spokesperson and help them to take part.

The adult facilitators from Group B recognised that it is essential to create an environment where children can invite friends or their families to participate in their game co-design. Group A thought that friends' and family participation would promote sharing ideas to co-design a game that suits most people.

[Group B] You can have like whole family, can come up with a whole family, siblings, friends

[Group A] By bringing the family in or getting them to ask people they know to generate ideas as well…that different knowledge is …going to help make something different

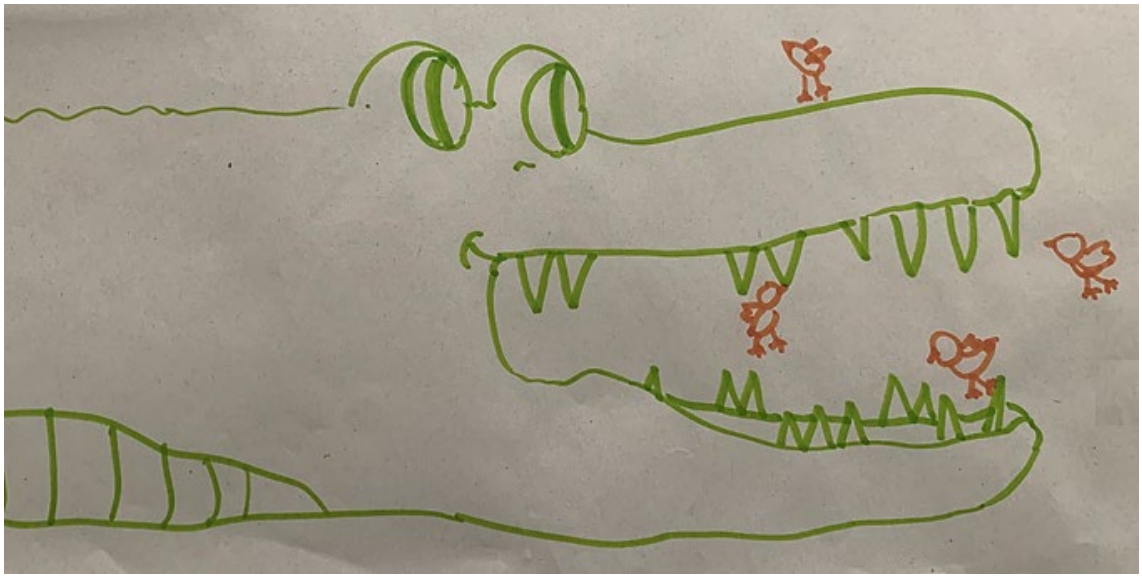
4.6 Theme 5. Fun and Gainful for Children

Adult facilitators created a space where children could organise themselves to engage with each other. This would promote motivation to generate ideas and create a space where children have fun and enjoy co-designing their games. Group A suggested that children may like to draw pictures for their co-designs. For example, this group drew a picture of a crocodile with flying birds. The concept around this picture is that birds clean the crocodile's teeth in nature. If birds are flying around the crocodile's teeth, but they are not sitting on the teeth, the teeth will not get cleaned by the birds (Figure 8).

> *[Group A] To promote the idea to the kids about making the game fun and enjoyable, we got …this crocodile …with birds on its teeth. If the birds are not cleaning around the teeth, they don't actually eat the bugs, so that is the idea… is pretty… iconic, really.*

Figure 8

The Crocodile and the Cleaning Birds.

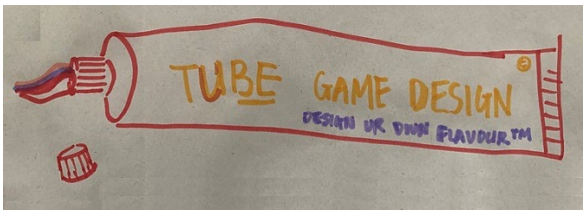


Another idea Group A developed was a picture of toothpaste with the slogan **TUBE GAME DESIGN.** The concept around this picture is that children may want to develop their toothpaste and flavours. The image highlights the **U** letter as being YOU (the game co-designer) (Figure 9).

> *[Group A] Then maybe you might want to come up with a slogan like …a toothpaste. I has TUBE on it but it has **U** highlighted as being YOU …as the game design then design your flavour again.*

Figure 9

TUBE GAME DESIGN Toothpaste.



The adult facilitators from Group A considered that children may want to experiment with models or objects to develop ideas about their game. Therefore, it is important to ensure children have time allocated for this activity.

> *[Group A] Children could experiment with the creation of their games with different materials and make it visual and friendly …like they could use tactile ideas with models*

The findings also demonstrated that the adult facilitators from Group B considered creating a space where children take full ownership of their game co-design and are in charge of setting their challenges and rewards. Children take control of the co-creation of game missions, quizzes, and rewards. Allowing children to do so will make the game fun, rewarding, and motivating.

> *[Group B] One thing about what we thought is that they might add a challenge, mission or reward… We figured that instead of just from us writing the challenges, we get the children to design their own challenges, so they become more incorporated in this.*

The adult facilitators from Group B believed that the challenges co-designed by the children could be more representative and exciting to them. If the challenges are created by someone else, they may not be what children want. This could be seen as something imposed on them, which goes against the principles of the PAR methodology and a critical theory approach, challenging the imposition of ideas from adults, without representing a child's voice.

> *[Group B] I think if we design the challenges, it wouldn't be …well representative. It will represent what we think they want to do rather than what they want to do. If we get them to make their own challenges …then it is more exciting for them rather than us trying to force something onto them that they might not want to do.*

Adult facilitators from Group B also looked at how children entertain themselves. One adult facilitator used a smartphone to search on Google for what games children play.

The adult facilitator found that children enjoy playing outdoor games such as physical or sports games. Group B looked at this from the point of view that these games require physical activity rather than games where they can be played on digital devices with no physical activity involvement.

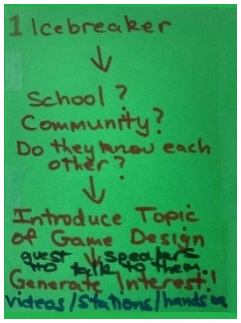
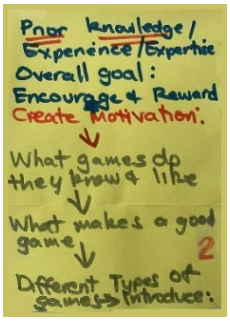
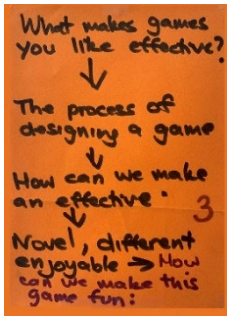
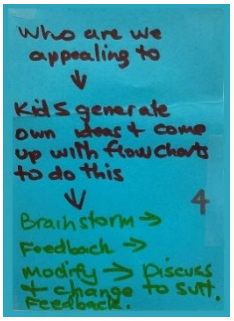
> *[Group B] The whole point of this really is …to bring incentive to brushing teeth. Because …kids play …they go outside and play. We did a bit of Googling and found that …a lot of kids like to play, you know …cricket or rugby… just like sport-type things. Then they can go to play marbles, they go around and play tag… they go around on swings. It is a very physical type of play rather than, you know …that digital aspect where people go on their phones or iPads.*

4.7 Additional Notes

The adult facilitators from Group A developed their brainstorm ideas in coloured sticky notes (Figure 10). These ideas were grouped and numbered in four additional notes to support the brainstorming and poster content. The brainstorming allowed this group to develop relevant ideas around the concept of 'I don't know what I don't know'. These notes were placed around the poster to support the development of other concepts and to give the poster a more creative look (Figure 4).

Figure 10

Coloured Additional Notes.

Note 1	Note 2	Note 3	Note 4
			

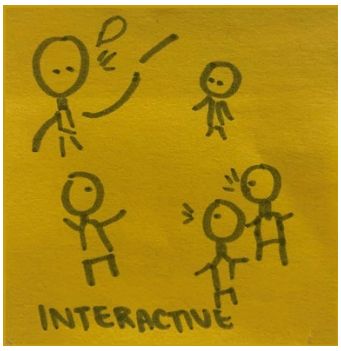
Drawing of pictures in coloured sticky notes to support their concepts, were placed around the poster to represent their creativity and ideas as shown in Figure 4 and as described below.

4.8 Providing a Space for Children to Interact

Figure 11 represents children interacting with their friends and family to share their knowledge, and experience. The picture also symbolises children taking ownership of their game and sharing it with their friends, family, and community. Children interacting with people is supported by the vision of the New Zealand Curriculum which is that students should be actively involved as members of their community to contribute to the well-being of themselves, families, whānau, and people around them (Ministry of Education, 2015). One of the key competencies of the New Zealand Curriculum focusses on participation and contribution of students to their communities. The competency includes the capacity of the students to contribute to their communities as a group and ability to engage with others to create members of the community to promote participation (Ministry of Education, 2015).

Figure 11

Interacting with Friends and Family.



4.9 Materials and Resources

Figure 12 emphasises the importance of allowing children to choose the materials and resources they want or could use to co-design their toothbrushing game. The adult facilitators from Group A emphasised the importance of respecting children's imagination and creativity. Children may want to include animation and storytelling elements in their games. Children may also want to use different types of materials and resources; therefore, funds to support these should be available to them.

Figure 12

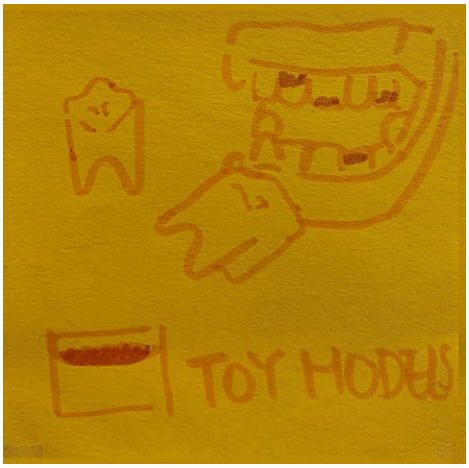
Materials and Resources.

4.10 Dental Models

Figure 13 represents the discussion about using objects in the game co-design. Children may want to use toys, dental models, or digital technology to support their toothbrushing game co-design. The adult facilitators from Group A were of the opinion that if children have full control co-designing their game, with materials of their choice, the game will be more appealing and effective to them.

Figure 13

Toys and Models.

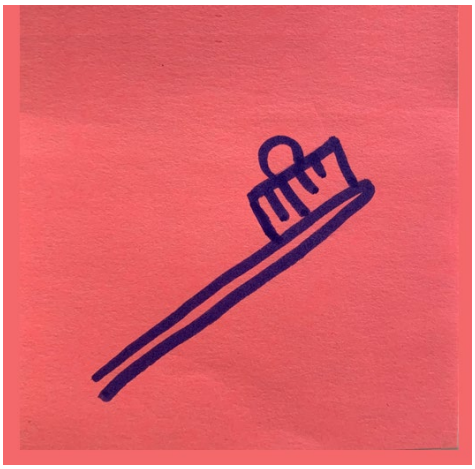


4.11 Toothbrushing

Figure 14 represents an idea of what children may like to include in their game to support their toothbrushing and promote oral health. Group A also emphasised that pictures could be used to introduce oral health topics to children.

Figure 14

Toothbrushing.



4.12 Happy Tooth

Group B also emphasised that including pictures to introduce the oral health topic is useful. Pictures like a tooth without dental caries or a healthy tooth could be used (Figure 15). The significance of this picture is that if teeth are not affected by dental caries, they are healthy and happy.

Figure 15

Healthy Tooth.

4.13 Summary of the Workshop

The themes were sent to the adult facilitators by email prior the meetings so they could have time to be familiar with the findings and concepts. During the reporting of the themes, I explained how I gathered the concepts and how I came up with the themes. The adult facilitators agreed with the findings and approved the concepts identified in the themes based on their suggestions. Some adult facilitators made recommendations about placing some concepts from Theme 1 into Themes 2 and 3, as they believed these concepts were more representative under these themes. For example, they suggested that the concepts of Introducing resources/tools/cost factors fitted well in Theme 2. The concept of providing clear/simple information relating to oral health and games fit better under Theme 3. The concept of Provide the means rather than the solution and Work with people rather than on the people are more representative if they are under Theme 2. Therefore, the table of themes (Table 1) is the result of the consultation and approval with the adult facilitators.

Adult facilitators from both groups also had the opportunity to make recommendations for future workshop sessions. One adult facilitator believed that the objectives of the workshop session were not very clear, so they did not know what was expected from them and recommended to make this clearer for future sessions. Another adult facilitator recommended to ensure there is equal field/background representation in the groups. One adult facilitator suggested to have more participants as they felt the groups were too small.

4.14 Chapter Summary

This chapter described the findings of the research. PAR was used in this research and data were generated through the participation and discussion of the adult facilitators in the workshops. The outcome of this engagement was the production of creative posters that represented the adult facilitators' collaboration, work, and ideas. As expected in PAR, the workshops produced new information with rich concepts about how to create a space for children in a classroom situation or other places to co-design games in oral health.

Five themes emerged from the analysis of these concepts. It was apparent that the adult facilitators strongly emphasised ensuring that children's voices and views are heard and respected. The adult facilitators also emphasised that children should be the ones taking control of their game design. Another important consideration was the promotion of an environment where friends, family, and other members of the community can participate in the co-design of toothbrushing games.

The results of the participatory data analysis arising from the workshops, the initial key concepts, and the relevance of each theme allowed me to provide the foundations for the creation of an adaptable lesson plan as presented in the next chapter. This artefact is created in response to the work done in creation of a space for children. The adaptable lesson plan, can be used for teachers and other adult facilitators in the promotion of serious games co-design practices using PAR.

Chapter 5 Critical Commentary: Part Two – An Adaptable Lesson Plan

5.1 Introduction: Developing the Adaptable Lesson Plan

In Chapter 4, I described how data analysis, themes development, co-designing, prosumerism, and PAR principles with children, together informed the development of an adaptable lesson plan. In this chapter—Critical commentary: Part Two— I discuss how the adaptable lesson plan (artefact) has the potential to be used by teachers or adult facilitators to create a space for children to co-design oral health games.

The artefact, as the practice-oriented research element of a Format Three of this thesis, aims to guide adult facilitators in creating a space for children using PAR to co-design a toothbrushing game. The facilitators are likely to be teachers in school settings, school public health nurses, oral health educators, and other professionals working with children in schools, clubs, and other spaces.

This adaptable lesson plan aligns with the New Zealand Curriculum framework, although primarily it is based on the principles of PAR and co-design. The adaptable lesson plan opens possibilities for teachers and adult facilitators to participate with children in co-designing a toothbrushing game. It also provides opportunities for children to become prosumers of oral health with the possibility and potential to challenge oral health policymakers

5.2 Teaching as Inquiry is Based on the New Zealand Curriculum

Teaching in New Zealand schools is based on the New Zealand Curriculum (Ministry of Education, 2015). The framework of the Curriculum uses the concept of teaching as inquiry. Teaching as inquiry is an approach that allows teachers to reflect on their practice to increase students' success (Buabeng & Akuamoah-Boateng, 2019; Ministry of Education, 2020). It is considered a practical approach that promotes teachers' learning to enhance children's learning. It is described as allowing teachers and adult facilitators to plan, teach, and reflect to improve the teaching and learning process (Buabeng & Akuamoah-Boateng, 2019). The concept is said to have a solid child-centred focus where the teaching is constantly refined to meet children's learning needs (Buabeng & Akuamoah-Boateng, 2019). However, it is unclear from the policy statements and guidelines to what extent the concept in the New Zealand Curriculum is child-centred.

According to Kilbane and Milman (2013), inquiry has been applied in teaching and learning since the 11th century, as mentioned in the *Book of Optics* by Ibn al-Haytham. In general terms, inquiry refers to observing, asking questions, consulting resources, sharing information, and reflecting on what has been found (Aslan, 2017; Te Kete Ipurangi, 2022b). In addition, it requires using critical reasoning and critical thinking by the inquirer, in this case children, about what has been found and learned in previous situations (Padilla, 2010).

The inquiry process is described as a two-way process in teaching and learning. Teachers and children are said to both use inquiry processes to gain knowledge—teachers through teaching as inquiry and children through inquiry-based learning (Ministry of Education, 2015; Te Kete Ipurangi, 2022b). The New Zealand Curriculum emphasises that teaching in New Zealand schools is based on a framework where teaching as inquiry is the main focus of teaching (Ministry of Education, 2015). It also emphasises that effective pedagogy uses teaching as inquiry, supported by a framework for teachers to apply inquiry concepts in their teaching.

The Ministry of Education website also states that children drive their learning using their curiosity, with an inquiry-based learning approach. According to the Ministry of Education, the approach allows children to connect, co-operate, and collaborate to find solutions to problems (Te Kete Ipurangi, 2022b). However, unlike the teaching as inquiry framework, the inquiry-based learning does not follow a framework to describe how children achieve their learning outcomes systematically. Although the Ministry of Education states that children's learning is based on inquiry-based learning, the New Zealand Curriculum lacks a framework to support this approach. Thus, neither the New Zealand Curriculum nor the Ministry of Education has an inquiry-based learning framework or model to suggest that children's learning is child-centred. The absence of an inquiry-based learning framework means that teachers still play a fundamental role in controlling and guiding children's learning.

To help in understanding the child-centred nature of the framework in relation to co-design, I developed a comparative table based on the two approaches—teaching as inquiry and inquiry-based learning (Table 2). The comparative table explains the differences and similarities of the inquiry process for teachers in teaching as inquiry and children in inquiry-based learning. The concepts in the left column (teacher's inquiry process) are concepts from the teaching as inquiry framework. The concepts in the right column (children's inquiry process) are concepts from different sections of the New Zealand Curriculum and the Ministry of Education website (Ministry of Education, 2015; Te Kete Ipurangi, 2022b). The concepts in the right column are more child-centred and

align with the purpose of this research approach. These concepts also align with the principles of co-design and PAR.

Table 2 *Comparative Table Based on the Two Approaches—Teaching as Inquiry and Inquiry-Based Learning.*

	Inquiry Process	
	Teachers (Teaching as inquiry)	Children (Inquiry-based learning)
Ask questions	Teachers reflect on their practice and ask themselves questions about their practice.	Children's curiosity enables them to ask questions about learning directions/ideas that interest them for further investigation. Children reflect on their learning.
Investigate	Teachers investigate for relevant information, new teaching approaches, and how these can be implemented in their teaching.	Children investigate new information about a specific topic. Children use resources they want to help them to investigate.
Process and analysis	Teachers analyse children's progress and identify what children need to learn next, and how their practice can be modified/adapted to meet the children's needs better.	Children analyse the information they have found and formulate it into ways that they can share and explain it.
Share findings	Teachers implement new teaching strategies and share them with children.	Children share their new knowledge with other children. They share their knowledge by engaging with their families and community.
Reflect and evaluate	Teachers evaluate the newly implemented strategies and reflect on their effectiveness.	Children compare, evaluate their findings, and reflect on what else they need to know. Finally, children reflect on how they can learn new things.

5.3 Inquiry-Based Learning

An inquiry-based learning approach is a process in which children are encouraged to ask questions, investigate the problem, process and analyse found information, share their findings, and reflect and evaluate their conclusions (Nazirah & D'oria, 2020; UNESCO, 2022). Thus, teachers or adult facilitators need to understand the inquiry-based learning approach to implement it and support children in their learning (Buabeng

& Akuamoah-Boateng, 2019). They also need to balance power difference when guiding and organising the children in co-design activities to create a sense of free discussion and participation (Morgan et al., 2002).

Inquiry-based learning is about the learner and the inquirer, in this case, children (Pedaste et al., 2015). It is a child-centred pedagogy driven by inquiry where children explore their curiosity to learn about the world (Buabeng & Akuamoah-Boateng, 2019; Ministry of Education, 2020). Rather than being told by the teacher what they need to know, children are encouraged to develop critical thinking skills through scenarios that promote interpersonal skills, sharing information, and group participation (Nazirah & D'oria, 2020; Roberts & Knaus, 2022). This way of learning promotes collaboration, so children find solutions to a problem (Te Kete Ipurangi, 2022b).

Different approaches can be used to promote inquiry-based learning with children. Some examples include the 5E model (Bybee (2014), which uses Engagement, Exploration, Explanation, Elaboration and Evaluation as a framework. The project approach, by Katz and Chard (2014), uses a three-phase approach—Curiosity, Creativity, and Communication (Clark, 2000). The inquiry-based learning framework created by Pedaste et al. (2015) uses a four phases approach—Orientation, Conceptualisation, Investigation, and Conclusion.

5.4 Child-Centred Approach

Some inquiry-based learning models align with PAR, and co-design, given that they place children's knowledge, language, and decision making at the heart of the learning process. A child-centred focus refers to an approach in which children are placed at the centre of the learning process and are active leading participants. PAR co-design with children challenges the views of adult-centred values where adults make decisions for children based on what they believe is best for them (Stedjeberg, 2017). Instead, a child-centred focus involves enabling children to be key decision makers and agents in learning opportunities where teachers act as the learning facilitator (Nazirah & D'oria, 2020; UNESCO, 2022). Co-designing approaches aim to empower children to share power inequalities in a way that allows them to participate in decision-making processes more equally in partnership with adults (Druin, 2002).

A child-centred focus is a way of teaching and learning that addresses power inequities between the teacher and the student. The child-centred focus encourages children to represent their voices, be active participants, and act as advisors and researchers (Horgan, 2017). The child-centred approach also aligns with Article 12 of UNCRC 1989.

To support a child-centred education, teachers select and use teaching strategies to support children's knowledge and control in the learning process, such as an inquiry-based learning approach where children guide their decision-making (Ministry of Education, 2015).

5.5 My Position as the Researcher in this Project

I am an oral health lecturer and researcher conducting research using PAR with co-design elements, using action-oriented workshops. I am not a school teacher. However, I identified that PAR and the co-design approach could be implemented in schools and other educational settings in keeping with the policy from the Ministry of Education and the New Zealand Curriculum. The adaptable lesson plan presented here is the artefact I designed based on the findings from the adult facilitators. It supports teachers and adult facilitators, such as oral health educators, to create a space for children to co-design their toothbrushing games using PAR.

The summary of themes presented and discussed in Chapter 4 (Table 1) provided me with the basis for the lesson plan. I first drew on the adult facilitators' feedback regarding the results. I then made minor corrections to the summary of themes based on the adult facilitators' responses. As indicated, this thesis follows Format Three structure focusing on practice-oriented research that includes an artefact. Thus, this approach enabled me to develop a lesson plan to be considered as the artefact for this thesis. To create a lesson plan that reflects the findings from the workshops, I analysed the adult facilitators' ideas in a critical way against the New Zealand Curriculum and PAR principles.

As I am not a school teacher, I needed to seek examples of lesson plans. For this, I searched the Ministry of Education website and (Te Kete Ipurangi, 2022a) website's for ideas about lesson plan templates. Te Kete Ipurangi (TKI) is the bilingual portal from the Ministry of Education that provides teachers with information and curricular resources to support children's learning (Ministry of Education, n.d.). I searched these websites using the terms 'lesson plans', 'lesson planning', 'planning lessons', and 'lesson plans for children'. I also used Google Scholar to search for lesson plans templates using terms such as 'lesson plans for games', 'creating space for children lesson plans', and 'New Zealand school lesson plans'. I searched for examples of lesson plans about classroom games from TKI Technology online to give me ideas about how to plan a lesson (Te Kete Ipurangi, n.d.).

I also consulted more generally with friends and family who are school teachers regarding their ideas about templates for lesson planning. I asked the AUT School of

Education for a copy of a lesson plan exemplar that student teachers use to plan their lessons during their practicums. Based on the research of websites, consultation with knowledgeable friends, the School of Education, and examples of different types of lesson plans, I developed a lesson plan as the artefact for this research project. I discovered that one lesson plan does not fit all teaching purposes. Therefore, I created a lesson plan adapted to a child-centred approach based on the workshos' findings and PAR principles (Table 3); hence, the name of the adaptable lesson plan. The adaptable lesson plan fits well with the New Zealand Health and Physical Education Syllabus from the Ministry of Education, 1999 and the health promotion domain (Ministry of Education, 1999).

5.6 The Aim of the Adaptable Lesson Plan

The aim of the adaptable lesson plan is to help teachers or adult facilitators create a space for children to become co-designers in oral health. The adaptable lesson plan has a child-centred focus, so children are supported to co-design their toothbrushing game. Strategies are suggested in the adaptable lesson plan using PAR with a child-centred focus.

The template for the proposed lesson plan is divided into sections. Each section informs the teacher or adult facilitator on how the lesson is structured and how the lesson is delivered (Table 3). I have created an example lesson plan for Years 7 and 8 that could be used in a school setting.

Table 3 *The Adaptable Lesson Plan – Example for Years 7 and 8 in a School Setting*

<table>
<tr><td colspan="2">Area of learning
Personal health</td><td>Year group
Years 7 and 8</td><td>Date/Duration of the activity
1.00 – 1.30 approx.</td></tr>
<tr><td colspan="3">Groups/Differentiation
Children will be invited to decide how they want to interact with each other.
Children may want to engage in small groups.
Children may want to participate with children of their same age, ethnic group, culture, language, gender, etc.</td><td rowspan="2">Resources
Children will be invited to bring games, toys, or other objects they want to include in their games.
The teacher or adult facilitator supports the activity by bringing:
Board/card games
Balls, hoops, string
Dice
Mobile phones, tablets
Internet access</td></tr>
<tr><td colspan="3">Links to New Zealand Curriculum
Health and Physical Education Syllabus (Ministry of Education, 1999)
Health promotion
Personal health and physical development
Level 3, Strand A: Children will be invited to identify from their own experiences and use their language, factors that affect personal, physical, social, and emotional growth and develop skills to manage changes.</td></tr>
</table>

- Children will be invited to identify from their own experiences and use language factors relevant to food and how these influence teeth.
- Children will be invited to identify factors relevant to body care about hygiene, such as toothbrushing.

- Paper, colouring pencils, markers etc.

Learning Intentions (Child determined)

- Children will be invited to design the learning activity, set the session objectives and style, and plan the group work.
- Children will be invited to collaborate to develop ideas about creating games that will encourage children to brush their teeth daily.
- The teacher's role is to support children's design and interweave key vocabulary or ideas about oral health.
- Children will be encouraged to ask questions to inspire them to develop their games.
- Children will be invited to develop co-designing skills in oral health.

Key Vocabulary

Children will be invited to share and use key vocabulary for their games, such as:

- Tooth decay
- Black holes
- Toothbrushing
- Toothpaste
- Flavours
- Challenges, rewards, and incentives
- Games
- Co-design

Success Criteria (Child determined)

Children will be invited to

- Work collaboratively, using their chosen design, objectives, and knowledge.
- Use information technology, diagrams, charts, and other forms of notation (e.g., mind mapping) to develop and present their ideas.
- Use various book and non-book resources to promote research background material.
- Consider the motivations and rewards for their games to encourage ongoing use.

Introduction (Child determined)

Children will be invited to

- **10 min**
  - Share their prior knowledge about their views and experiences with games and oral health.
  - Express their opinions about the importance of toothbrushing and games so they can personalise their games.
- **30 min**
  - Play a range of familiar games (virtual and non-virtual) and identify those they like playing and the features of the games that contribute to their enjoyment and learning.
  - Develop a list on the whiteboard of all the attributes they identify from the games they enjoy.
  - Develop an agreed list of critical attributes for games.
  - Discuss key game attributes that can be applied to a tooth brushing game.
  - Discuss how a game could be used to promote daily toothbrushing using the Internet.

Key Questions

Children ask questions

- What games do we like?
- What are the key elements of a good game?
- If we were going to make an excellent game, what would be its key attributes?
- What games can we make with paper and pens?
- What games can we create with dice, balls, or hoops?
- Why is daily toothbrushing important?

Activities/Experiences – this is the least child determined set of activities **30 min** ▪ Children will be invited to demonstrate toothbrushing from their experiences and share these. ▪ The teacher or adult facilitator's role is to share their experiences of toothbrushing and refer to some good examples of toothbrushing – explore additional ideas beyond those children suggest for the importance of preventing dental caries. ▪ Children will be invited to organise their group brainstorming and mind-mapping to develop ideas about possible games. ▪ Groups will be invited to use their generated ideas to develop and describe the outline of a potential game. ▪ Groups will be invited to select a way to present their potential game to the class (using charts, diagrams, information technology etc.). ▪ Group presentations with critical feedback will be invited to encourage further refinement and development of the concepts presented.	▪ How can the game we just created/played inspire you to remember to brush your teeth every day? ▪ How can the game we just created/played be played on a device using the Internet?
Conclusion and Assessment – This aligns more closely with PAR Children will be invited to ▪ Reflect on the experience and summarise what they see as successful about the sessions. Children may use post-it notes for reflection and their suggestions for improving sessions. ▪ Write reflective notes about how the lesson went and identified areas for improvement. ▪ Create their own game, present it to the rest of the class, and compare it with other games. ▪ Decide what game they created as a group is best for promoting daily toothbrushing using the Internet.	**Evaluation/Next Steps** Children use the success criteria to evaluate the effectiveness of the toothbrushing game.

5.7 Discussing the Example Lesson Plan

5.7.1 Area of Learning

Here I discuss the different components of the lesson plan in creating a space for children to co-design a toothbrushing game. For this adaptable lesson plan example, I selected the topic of ‘Personal Health’ from the New Zealand Curriculum as the area of learning. In the New Zealand Curriculum, there are eight learning areas, one being Health and Physical Education. The focus of Health and Physical Education is that children learn how to maintain their well-being and that of their communities. The learning area of Health and Physical Education relies on four strands: Personal Health and Physical Development, Movement Concepts and Motor Skills, Relationships with Other People, and Healthy Communities and Environments (Ministry of Education, 2015). There are

also seven key areas of learning in Health and Physical Education linked to the strands; these are: mental health, sexuality education, food and nutrition, body care and physical safety, physical activity, sports studies, and outdoor education. The key area of learning about body care focuses on personal body care of personal hygiene, including teeth (Ministry of Education, 1999). Therefore, the concept of toothbrushing fits firmly within the key area of learning about personal health. Maintaining good oral health to prevent dental caries through toothbrushing is an essential aspect of everybody's personal health (Akkaya & Sezici, 2021).

Food and Nutrition is also one of the seven key learning areas in which children develop skills to identify healthy food and how food choices contribute to their well-being. They analyse how food choices and eating patterns are influenced by culture, technology, and society and how these choices influence the physical, social, mental, and emotional feelings of well-being (Ministry of Education, 1999). The toothbrushing concept fits well in this area as children will learn that food and drinks with high sugar content contribute to dental caries development.

As the Health and Physical Education learning area focuses on promoting children's well-being, body care also focuses on the mental, emotional, and social aspects that contribute to children's well-being. Children develop knowledge and skills to prevent infections and diseases in the body care key learning area which fits well with toothbrushing, as daily toothbrushing will prevent dental caries and, subsequently, other oral diseases and conditions. Children also develop attitudes and values that influence them to take responsibility for their well-being, and that of their communities, through health promotion (Ministry of Education, 1999). Children have the potential to be ambassadors for oral health.

5.7.2 Year Group

The New Zealand education system for schools comprises 13-year levels. Years 1 to 8 relate to children's attendance in primary education. Children attending primary education are between 5 and 12 years of age. Years 9 to 13 relates to children's attendance in secondary education. Children attending secondary education are aged between 13 and 17 years (Ministry of Education, 2021b).

The year group section of the lesson plan informs the reader about the school year level the lesson is designed for. The year level provides the teacher and adult facilitators an opportunity to review the lesson's content to ensure it is appropriate for the year level. It also includes information about what changes may need to be made if the school level is different.

I proposed a lesson designed for Years 7 and 8 which bridge primary and secondary school. I selected this age group as they will soon move from being primary school children to pre-adolescents, adolescents, and adults. They will increase Internet use to support their academic learning (Park & Kwon, 2018), become more independent from their parents, and begin to make decisions about their well-being and lives (Horgan, 2017). This age group also has vulnerability for developing dental caries in permanent dentition (Konthoujam & Kalita, 2020).

Children are great Internet users and like to use technology such as smartphones, tablets, and other digital devices. In the curriculum learning area of technology, children learn to become innovative and creative developers of their products (Ministry of Education, 2015). As good consumers of technology, they have the potential to become prosumers by creating and sharing new information with their friends and family (Gerhardt, 2008; Jenkins et al., 2009). For example, children have the potential to share their toothbrushing games with their friends and families through the Internet. The adaptable lesson plan provides an opportunity for creating a space for children of different age groups with the adaptability to be used in other settings outside the classroom. Other locations that can be used to provide space are maraes, Kiwanis Kids clubs, Lions Club New Zealand, community centres, GameOn clubs, after school programmes, After School Board Games club, holiday programmes, and sports clubs.

5.7.3 Date/Duration of the Activity

This field states the date when the lesson is to be taught. The purpose of displaying the date is to ensure that the lesson is aligned and delivered at a time that follows previous relevant topics (Amos, 2010). The duration of the lesson plan is essential information as it determines how much time the children will be required to spend doing these activities and that the lesson is congruent with other classroom learning activities. I suggest that the lesson time is between 1.0 to 1.5 hours with some extra time to prepare and finish answering questions from the children.

5.7.4 Groups/Differentiation

This section indicates how the children could organise themselves for the activity. The content of this section is in response to the findings from the workshops and follows the principles of the New Zealand Curriculum, as well as my expertise in teaching. Results from the workshops suggested that the following aspects should be considered in planning a group activity: student age, culture, language, gender, personality, motivation, and complexity of the activities.

The Curriculum states that all children must be engaged, challenged, and supported in their learning (Ministry of Education, 2015). The Curriculum also has a strong view about ensuring that the culture and traditions of children are valued and that their identities, abilities, languages, and talents are recognised. During teaching sessions, the children should be encouraged to recognise the importance of excellence, innovation, inquiry, and curiosity. Other things such as diversity, equity, community and participation, and respect for others, are essential aspects that children learn to recognise and value (Ministry of Education, 2015).

I proposed that children decide how they want to collaborate. Depending on the class size, they may want to engage in small groups, in pairs, with mixed cultures, languages, gender diversity, or as a whole class. This approach may promote more diverse learning that aligns with the New Zealand Curriculum and my experience in teaching. Enabling children to organise themselves aligns with PAR principles within a child-centred focus. The approach may also encourage children to develop skills in social relationships and promote opportunities for them to discuss social problems (Morales, 2016).

PAR intends to produce knowledge that can be implemented in communities (Horgan, 2017; MacDonald, 2012). Therefore, allowing children to organise themselves will enable them to discuss freely with their peers and provide a range of ideas about oral health and games that can be implemented in their communities (Horgan, 2017; Krol et al., 2014). The children may also want to decide who in their community can use the toothbrushing game they co-designed. The role of the teacher and adult facilitator is to ensure that children are the ones who decide how they organise themselves. Another essential role of the teacher and adult facilitator is to assist, support, and encourage children to interact with each other in a group situation (Davis, 2016).

5.7.5 Resources

The findings from the workshops suggested that resources should be provided, so children co-design their toothbrushing game with materials of their choice. Children may want to bring board games or games they like or know. They may also want to use a variety of objects or toys to help them with their creativity in co-designing their toothbrushing game. They may want to include a song, dance, video, heroes, myths, and legends in their game design.

Based on these findings, the role of the teacher or adult facilitator is to support children in bringing their desired games, toys, and objects. The teacher or adult facilitator could support the activity by bringing board games, card games, balls, dice, colouring pencils, paper, markers, digital devices (smartphones, tablets, computers) and access to the

Internet to co-design the toothbrushing game. Providing various resources will encourage children's motivation and creativity in their co-design (Te Kete Ipurangi, n.d.; Thabrew et al., 2018). In addition, providing children with various resources will guarantee the success of creating a space for children to develop their ideas about games and use them in oral health (Amos, 2010).

5.7.6 Links to the New Zealand Curriculum

The content of this section is linked to the New Zealand Curriculum. Oral health falls in the key area of learning about Personal Health and Physical Development. In this key area of learning, children learn to identify factors that affect their personal, physical, social, and emotional growth. This aim is for children to make positive changes to improve their health.

Level 3 in the lesson plan refers to the achievement objective. An achievement objective is a key learning outcome for a particular teaching level. There are eight achievement objective levels in the Curriculum. The content of each level is appropriate for the children's development and maturity as this is the stepping level to progress from primary to secondary education. The content of these achievement objectives is based on what the children most likely would encounter in their everyday lives. I decided to use Level 3 in this lesson plan as Years 7 and 8 fall into the Curriculum's Level 3 achievement objective band (Ministry of Education, 2015).

Strand A refers to the area of personal health and physical development. In this area, children develop skills in understanding to meet their daily health and physical activity needs. Children also learn about what factors influence their well-being and develop the skills to manage and enhance their health. The strand strongly focuses on encouraging children to take responsibility for their health and how this can change their lives (Ministry of Education, 1999).

Thus, this section focuses on children identifying factors affecting their bodies, particularly oral health. Children will be invited to use their language and experience to identify these factors that affect their oral health and develop skills to manage these factors, emphasising a healthy diet and toothbrushing.

5.7.7 Learning Intentions

This section informs the teacher or adult facilitators that children are provided with a child-centred space. In this space, children will be invited to organise themselves in groups to collaborate and develop skills in co-designing oral health games (Ministry of Education, 2020). This space may also enable children to discuss and share ideas and

vocabulary about what they know in terms of oral health and games. Children will be encouraged to design the style of the session and will set their objectives for the co-designing session. The children, rather than the teacher or adult facilitator, will be invited to make seating arrangements.

The intention is that children collaborate in child-centred workshops to develop ideas about creating games to promote toothbrushing. A child-centred workshop will involve teachers, or adult facilitators, sharing power with children. Therefore, the teacher or adult facilitators will work in partnership with the children, so children feel there is a sense of an environment where they are free to participate (Morgan et al., 2002). The role of the teacher or the adult facilitator is to support children's co-design activity and provide vocabulary or ideas about oral health. In addition, the teacher or adult facilitator may ask open-ended questions to inspire children to respond as makers of their games.

All of the above, combined, will create a space in a child-centred environment along with children's experience and knowledge about games to facilitate collaborative creativity to co-design their own toothbrushing game (Thabrew et al., 2018).

5.7.8 Key Vocabulary and Children's Vocabulary About Oral Health

As this is a new learning area for the children, it is essential to state the key oral health vocabulary they will learn and use during the co-design activity (Amos, 2010). Children will use the vocabulary they know and, simultaneously, discover a new language they need to use for their game co-design. Children will need a space to present their knowledge, terms, and ideas, and share these with their groups. Children may also want to use vocabulary in a different language or vocabulary from their families.

The role of the teacher is to support children's exploration of new vocabulary using different resources to read and understand new concepts. The teacher or adult facilitators also need to be clear and use easy vocabulary to be understood by children with English as their second language (Ministry of Education, 2015). The findings from the workshops suggested that children should be familiar with the terminology of the topic. This raises the concept from workshop A — *'I don't know what I don't know* '— which emphasised that it is essential to understand and know the vocabulary and concepts first so children can then learn and understand.

Based on the findings from the workshops, and with the recommendations from the New Zealand Curriculum, I suggested some basic vocabulary the children would need to be familiar with and understand. As this is only a suggestion, the teacher or adult facilitator may want to include other necessary vocabulary such as, *tooth decay, black holes, toothbrushing,* toothpaste, to support the children with language for their game co-design.

5.7.9 Success Criteria

This section refers to monitoring the children's learning progress and supporting their success in achieving their learning outcomes. The workshops suggested that it is a good idea to look back and re-assess if all aspects of co-designing a game have been covered so there is a clear understanding that the learning outcome has been met. To evaluate the success of the learning intention and the success criteria, the teacher or adult facilitator will observe the children's interactions. The success criteria will be met when the teacher or adult facilitator is satisfied that children have demonstrated the ability to assess their work collaboratively, engaging with other children and creating learning opportunities for other children in the group (Ministry of Education, 2015). Teacher or adult facilitator belief that success criteria have been achieved will be reinforced by the children's own evaluations of their work, when they measure their outcomes against the stated success criteria. Involvement of children in the co-construction of success criteria, prior to the learning activity, gives children greater ownership of the learning process along with markers for them to measure their progress against, both during and after the lesson.

Another important aspect of this section is to inform the teacher and adult facilitator that it is essential to support children's requests to use different types of resources they want, such as books or non-book (Thabrew et al., 2018).

The workshops also suggested that providing children with the resources, and the space to work with others, is like '*providing the means rather than the solution'* and '*working with people rather than working on the people*'. Therefore, I suggest that children use a range of book and non-book resources to search for the information they need. I also suggest that children decide what co-design style they prefer. For example, children may want to use information technology through their digital devices to search for and collate information using mind-mapping, charts, posters, flow charts, paper, colouring pencils, markers, and other stationery. Children will develop their game challenges and rewards to promote the ongoing playing of the toothbrushing game as suggested by the workshops.

5.7.10 Introduction of the Topic

This section informs the teacher or adult facilitator about how the topic is introduced to the children. As indicated in the key vocabulary section, new vocabulary and concepts will need to be introduced to support children's learning (Amos, 2010; Ministry of Education, 2020). Strategies to introduce new vocabulary and concepts could include gathering prior knowledge from children about oral health and games.

I suggest asking children key questions about oral health and games to generate interest and participation in the discussion. I propose that the introduction of the topic is conducted in two parts. For the first 10 minutes, children share what they know and what experience they have about oral health, toothbrushing, and games. The purpose is to generate vocabulary from the children's experiences. The role of the teacher or adult facilitator is to guide and ask children key questions about their experience in toothbrushing and games to generate the vocabulary. The teacher or adult facilitator may need to contribute with new vocabulary to support the introduction of the topic.

In the second part, 30 minutes is given for children to engage in activities to promote discussion and generation of new concepts (Thabrew et al., 2018). Children will play a range of games they know or like. These games can be virtual or non-virtual. Children will develop a list of attributes about the games they play or like. Children will also discuss and list game attributes they would like to include in their new toothbrushing game co-design. Children will discuss using a game to promote daily toothbrushing using the Internet. The role of the teacher or adult facilitator is to ensure that all children are engaged in playing and participate in generating new concepts (Ministry of Education, 2015; Morris, 2017).

The strategies I suggest in this section reflect the findings from the workshops. The workshops also indicated that the topic could be introduced by a guest speaker such as a game specialist or developer. The game specialist could bring examples of games to support the introduction of the topic, such as videos, ideas, or game stations. Using game stations could be an excellent motivation for children to co-design their toothbrushing games.

The sequence of these activities will encourage opportunities for children to discuss how the game could be developed and used to promote daily toothbrushing.

5.7.11 Key Questions

Teaching and learning are about implementing strategies so that teaching, learning, and participation are enhanced (Amos, 2010). In the discussion of the introduction section, I mentioned a strategy that could be used, such as gathering children's prior knowledge about oral health and games. This section focuses on developing key questions to encourage children to reflect on their experiences and promote discussion sharing their findings. This section aligns with the workshops' findings, suggesting that for children to understand the topic, a set of initial guidelines needs to be implemented, so they are guided to understand the topic. These guidelines could be a set of key questions.

To introduce the topic to the children, I propose using key questions to encourage children to think about what the purpose of the lesson is. Key questions such as ‘What games do we like?’ or ‘What are the attributes of a good game?’ will encourage children to think about their experiences playing games. Then questions related to oral health and toothbrushing, such as ‘Why is daily toothbrushing important?’ or ‘How could a game be applied to promote daily toothbrushing?’ will encourage children to think that toothbrushing could be used as part of a game. Key questions will enhance children’s learning by integrating what they already know and understand about games with new concepts (Ministry of Education, 2015).

The role of the teacher or adult facilitator is to encourage children to ask questions during the co-design activity. Children may want to ask questions relevant to oral health, games, or the type of materials they can use. For example, they may want to ask if they could use digital devices to support their toothbrushing game co-design. There is a vast range of possible questions children may ask. Therefore, I propose that the teacher and adult facilitator work in partnership with children to support their questioning skills by asking children questions such as ‘What are the elements of a good game?’ ‘What games can you do with paper, pens or toys?’. I have proposed a list of possible key questions, but this does not mean that the teacher or adult facilitator should limit themselves to this set of key questions.

5.7.12 Activities/Experiences

This section refers to the activities the children may be engaged in using their knowledge and experience in oral health and games. The workshops suggested creating a fun and rewarding environment to promote children's interest and participation. Some strategies suggested by the workshops were brainstorming, mind mapping, flow charts, experiments, tactile ideas, and visual ideas.

Based on the findings from the workshops, and my experience in teaching, I propose to spend 30 minutes on this activity. I have listed some activities as part of these strategies to enhance children's participation. I suggest using strategies such as toothbrushing demonstrations with plastic models to show how to brush the teeth. This space may enable children to control their activities and discuss oral health issues, toothbrushing techniques, and games (Nind, 2011). Using a plastic model, children will demonstrate brushing techniques based on their knowledge and experience. Children may organise themselves, brainstorm and mind map to share ideas about co-designing a toothbrushing game.

The role of the teacher and adult facilitator is to support children's creativity with resources needed for their co-design. For example, the teacher or adult facilitator will provide a plastic dental model for children to demonstrate how they brush their teeth. The teacher or adult facilitator will also show how to brush the teeth correctly and the importance of preventing dental caries. One of the limitations of this activity will be the availability of resources, which the teacher or adult facilitator should try to provide. Another essential role of the teacher or adult facilitator is to encourage the active participation of the children in the activities. Hence, children feel they are included and part of the group (Ministry of Education, 2015).

5.7.13 Conclusion and Assessment

In this section, the teacher or adult facilitator states how the children will assess the success of their activity. I suggest that children be encouraged to provide feedback about how the adaptable lesson plan supported them in co-designing their toothbrushing game. Children will reflect on this experience, and what aspects of the lesson plan need to be improved for future sessions. Children will decide how they would like to provide feedback. A suggestion is that they could use post-it notes on a whiteboard to share their thoughts with other members of the class.

The workshops suggested that children could evaluate their games by providing feedback to each other, making any changes to their games, and vote for their favourite game they created in class. Then, children will decide how they want to present their ideas to the rest of the class, highlighting the importance of their game. A suggestion by the workshops is that children may want to use flow charts, diagrams, pictures, video, digital technology, or other methods they prefer. Children presenting these ideas to the rest of the class will enhance their skills and capacity to assess themselves and their peers (Ministry of Education, 2015).

The role of the teacher or adult facilitator is to reflect on the effectiveness of the adaptable lesson plan. The teacher or adult facilitator will assess how each section of the adaptable lesson plan met the learning intention and suggest future lesson planning. Notes on what the children know, what they can do, group feedback and feedforward, and what they are learning or what they need to learn will give direction about what is required next to improve the lesson (Morris, 2017). Recommendations on what to improve or any suggested changes should be listed here for future reference. The teacher or adult facilitator critically reflects on how the adaptable lesson plan created a space for children to co-design a toothbrushing game in a child-centred environment based on the following:

- Work with children in partnership in co-design activities
- Create a child-centred environment to promote participation
- Share power opportunities with children so they are in control of their co-designs
- Listen to children’s voices and respect their views and opinions about oral health promotion and games
- Allow children to use their creativity using materials or resources they prefer
- Support and provide children with resources they prefer

5.7.14 Evaluation/Next steps

Children will use the success criteria to assess the effectiveness of their toothbrushing game. I suggest giving children the opportunity to evaluate and discuss with the teacher or adult facilitator about the lesson plan, the co-design activities, the resources they used, the partnership, and the effectiveness of their toothbrushing game. Children may want to make suggestions for future oral health lesson plans. These suggestions will enhance the children's capacity to reflect and assess themselves as a group. This evaluation will also allow the children to reflect on what they need or want to do next (Ministry of Education, 2015). As indicated by the workshops, children may want to use digital devices to promote their toothbrushing game by inviting friends and family to join the game.

5.8 Chapter Summary

The research project findings respond to the research question: creating a space for children to co-design a toothbrushing game as a serious game to promote oral health using PAR. The research focus was on using PAR as a methodology in a child-centred environment. Adult facilitators engaged in workshop activities to develop ideas about how to create opportunities and space for children in co-designing a toothbrushing game. The findings from the workshops informed the creation of an adaptable lesson plan, as an artefact, that is aligned with the New Zealand Curriculum. The adaptable lesson plan provides example teaching and learning strategies for teachers and adult facilitators to create a child-centred learning environment. PAR is applied in the child-centred approach to developing children's ideas about oral health promotion, particularly with toothbrushing.

The resources used in the adaptable lesson plan to support children's co-design are immense. The use of resources will depend on children's motivation, interests, creativity, and curiosity about the resources they can use. The adaptable lesson plan proposes

using resources such as board games, dice, balls, etc., but this is only a suggestion. Children may also want to use the Internet and digital technology to co-design their games. With easy access to digital devices such as tablets, smartphones, and Internet, children could build new material or change existing material using sophisticated tools. As discussed in Chapter 2, children as prosumers have the potential to use technology to support their co-designs of oral health games and use the Internet to disseminate their games to their friends, family, and community.

The key ideas that emerged from the exercise of drawing from the New Zealand Curriculum and developing an adaptable lesson plan for this project are to:

- Work with children in partnership in co-design activities
- Create a child-centred environment to promote participation
- Share power opportunities with children so they are in control of their co-designs
- Listen to children's voices and respect their views and opinions about oral health promotion and games
- Allow children to use their creativity using materials or resources they want
- Support and provide children with resources they prefer

The advantage of the adaptable lesson plan is that it can be adapted to any learning level and space. The other benefit of the lesson plan is that it strongly focuses on creating a space for children with a child-centred approach to encourage group work and participation to develop creativity and ideas to co-design a toothbrushing game as a serious game.

Chapter 6 Reflection and Evaluation

6.1 Introduction

Dental caries is a preventable disease. However, dental caries continues to be one of the most discussed topics in dentistry and public health. Despite the efforts to eradicate it, dental caries remains a significant public health concern in New Zealand, especially among children (Masood et al., 2012; Moffat et al., 2017).

In New Zealand, efforts to prevent dental caries in children have a long history since the introduction of the SDS in the 1920s. Although the government has supported the SDS (now the COHS), challenges and inequalities in oral health still exist, mainly among Māori and Pacific communities (Moffat et al., 2017). As recommended by the WHO, implementing oral health and toothbrushing programmes in primary schools in New Zealand and other countries appears to be an alternative strategy to prevent dental caries in children (Cakar et al., 2018; Petersen, 2003). However, even though schools have appropriate settings to promote oral health, it is evident that researchers face many difficulties in organising and conducting oral health programmes on such a scale and without additional assistance, such as training and guidelines. This places the usefulness and effectiveness of these programmes in question (Rosema et al., 2012). Thus, the lack of support for oral health and toothbrushing programmes in New Zealand schools, the shortage of oral health practitioners in the COHS, and the inequalities in access to oral health care for Māori and Pacific children continue to be a serious concern.

This project highlights the need to explore alternative approaches. The study aimed to provide child-centred opportunities to create space for co-designing games to promote oral health. These games, developed by children as serious games, have the potential to challenge oral health policymakers to consider an alternative approach to preventing dental caries.

The significance of this research highlights the importance of working with children in partnership, so they have equal opportunities to participate in decision-making in oral health promotion (Bennett, 2019; Shier, 2001). It also highlights the need to explore children's participation in oral health promotion as advisors, designers, and evaluators (Horgan, 2017; Loveridge, 2010). This research used PAR with adult facilitator workshops to offer co-design options, furthering future potential resulting from this project.

6.2 Summary of Findings

The findings from the adult facilitator workshops are summarised as follows:

- Children should be able to work collaboratively to co-design their toothbrushing game to promote oral health.
- Children's voices and ideas are to be respected and supported with resources of their choice.
- Clear and simple information about oral health and co-design of games can be provided to children.
- The generation of ideas and creativity can be promoted in a participatory environment aligned with PAR.
- Children must be in charge of their co-design choices.
- Children can develop their game objectives, challenges, and rewards.

My learning about, and application of, PAR, co-design principles, and a child-centred approach, has given me the tools and skills to propose an adaptable lesson plan that reflects the adult facilitators' views to be applied by teachers and children.

6.3 Limitations of the Research Project

Limitations in research refer to the weaknesses that shape the direction of the research, the results, and the conclusion (Ross & Bibler, 2019). In Chapter 1, I described the difficulties I encountered in conducting this research. One limitation was the inability to recruit children as participants as a result of COVID-19. Consequently, adult facilitators were recruited instead. It is my view that for future research projects with children, COVID restrictions may not be a barrier to recruiting children. However, there is always the possibility that recruiting children for research purposes may not be possible due to different reasons; for example, schools may see these types of projects as an additional imposition on an already crowded curriculum. Teachers may not want to participate as it could be an extra activity for them. Parents may not want their children to participate in research activities for ethical reasons. There is always the possibility that different pandemic events may arise preventing conducting research with children. Other limitations were the lack of literature available to suggest that children participate in the co-design of oral health serious games and gathering the adult facilitators to discuss and review the themes all at the same time.

6.4 Recommendations for Future Research

The findings from this research project identified a gap in the inclusion of children in oral health promotion practice and research. Furthermore, it is evident that children's participation in the co-design of serious games for health, including to promote oral health, is not a frequent consideration.

Therefore, based on the findings from the adult facilitator workshops, the literature review, PAR and co-design principles, this research project makes the following recommendations for future research in oral health promotion with children:

- Explore children's ability to become prosumers and ambassadors of their oral health co-designs so they can share it with friends, family, and their community to promote oral health.
- That oral health promotion approaches with children are explored in partnership with policymakers to review and consider alternative oral health programmes.
- That children's voices are included in practice and research to advise and support oral health policymakers in designing oral health programmes for children.
- That children's participation and voices are respected as co-researchers, advisors, creators, and evaluators of their game co-designs to promote oral health.
- The Ministry of Education supports those co-designing activities with children, the Ministry of Health, schools, teachers, oral health practitioners and communities.
- To create an environment where teachers or adult facilitators work in partnership with children in oral health co-design guided by an adaptable lesson plan.
- That the adaptable lesson plan is used, as a tool, by teachers or adult facilitators in a child-centred environment such as schools, maraes, community centres, clubs, after-school programmes, and sports clubs.

6.5 Implications of Recommendations for Policy and Practice

The recommendations may influence the reviewing of current practice about oral health promotion, teaching, and delivery. It may also influence policymakers and researchers to explore alternative approaches that are child-centred to inform practice at different levels. Exploring children's curiosity, creativity, and ability to become prosumers and ambassadors of their co-designs has the potential to be shared with policymakers, the Ministry of Health, the Ministry of Education, and communities to develop oral health programmes. Thus, the recommendations may influence the following areas.

6.5.1 Implications for Policymakers

Partnering children with policymakers has the potential for reviewing and exploring alternative methods to develop oral health programmes that are more child-centred and reflect the children's voices and points of view (Bennett, 2019; Shier, 2001). The benefit is that children can act as advisors, creators, and evaluators of their co-designs and oral health promotion to inform practice (Loveridge, 2010).

6.5.2 Implications for the Ministry of Health

As co-researchers of oral health, children's voices and opinions could significantly inform the Ministry of Health to update oral health information and resources for the public on the website. It will also inform the Ministry of Health of the need to support children's views in co-designing oral health activities with funding allocated to support their creativity and co-creations (Ritterbusch et al., 2020). Support is needed for children's oral health games co-designed activities, in partnership with policymakers, to develop oral health programs that reflect children's views (Ritterbusch et al., 2020). Children have the potential to become prosumers in oral health by using technology in fun ways to promote their oral health co-designs, like a toothbrushing game. Encourage children's prosumerism in oral health and support the development of digital applications created by children to be accessible to a broader community targeting children. These approaches may have a positive long-term impact in reducing dental treatment delivered by COHS and likely cost-effective for the Ministry of Health.

6.5.3 Implications for the Ministry of Education

Children's views could inform the Ministry of Education to review the teaching and learning of oral health in the New Zealand Curriculum. A more evident child-centred approach is required in education where children use inquiry by collaborating with teachers or adult facilitators in a space where partnership and participation are enhanced to develop their oral health games and oral health promotion activities.

6.5.4 Implications for Communities

That communities such as schools, clubs, or other community-based venues participate and support children and their families in creating a learning space. It is apparent that these community-based venues will need to be accessible for this purpose. Providing children with a learning space will also promote participation and the ability to develop their co-design skills in oral health supported by an adaptable lesson plan.

6.6 Researcher Reflections

This research journey has challenged my thinking about research, mainly as this is the first time, I have conducted research using PAR. In general, it has been a great learning experience. I have learned that conducting research presents obstacles and challenges that can alter or change the direction of the research. This project has challenged my thinking about the ways to conduct research with children. The practice-oriented research of this project has enabled me to develop new skills that I can use in my future professional practice from different perspectives as follows.

6.6.1 Reflection as a Practitioner

- As a practitioner, one of my roles is promoting oral health. Therefore, my experience and knowledge from this research project can be applied to support children in co-designing games to promote oral health.
- I know more about creating a space for children and using oral health concepts within a child-centred approach.
- This knowledge can potentially support teachers or adult facilitators in developing lesson plans.
- I understand now that working in partnership with children, oral health promotion can be simple, enjoyable, fun and, perhaps, more efficient through co-design.
- The project has given me purposeful opportunities to examine how the Ministry of Health and the Ministry of Education promote oral health for children. The project also challenged me to find ways that could enhance this work.
- The project has enabled me to thoroughly investigate the views and ideas expressed in the New Zealand Curriculum regarding how they support children's oral health learning.

6.6.2 Reflection as an Educator:

- My eyes have been opened to the benefits of child-centred learning, with children being given opportunities to design their learning pathways through inquiry.
- My role as an educator is not didactic but as a facilitator working and learning alongside the children.
- I have investigated and developed teaching skills that can be used to support children's learning about oral health.

- I have learned that children should be given space to be the drivers of their learning by establishing learning environments where participation is promoted.
- I recognise the value of supporting children's views about their games in oral health and the need to provide them with the resources they require that will enable them to co-design their games/activities.
- My work in this field, along with my existing expertise in tertiary teaching, has given me the potential to work with teachers or adult facilitators in supporting the teaching skills utilised in a child-centred approach to learning.
- I have developed a greater familiarity with PAR and, consequently, I now have a much better understanding of the importance of empowering children to participate as co-researchers.
- The project has helped me reflect on my teaching practice in terms of how I can implement tools, strategies, and adaptable lesson plans that support children in co-design activities.
- I have an increased understanding of the New Zealand Curriculum and how it can be implemented and adapted to meet specific learning needs in oral health.
- The teaching and learning skills and strategies I have gained through my investigations of approaches applied when working with children are readily transferable to my practice as an adult educator.

6.6.3 Reflection as a Researcher:

- The outcomes from this research project have given me an understanding that there are opportunities and possibilities to include children and be guided by children's voices in oral health research projects.
- I have gained skills to challenge oral health promoters and oral health policies on how children may play a more significant role in the development of their own health promotion activities.
- It has opened my eyes to the fact that the exclusion of children's input in the development of health promotion activities has created a gap in oral health promotion that needs to be addressed.
- It has challenged me to look for opportunities to create learning environments where children can drive their learning pathways in oral health.

6.7 Contribution of the Research

To my knowledge, this study is original in that it looks critically at creating a space for children to co-design their toothbrushing games to prevent dental caries. The research shows that dental caries in children is still a public health problem in New Zealand, particularly among Māori and Pacific children (Kanagaratnam & Schluter, 2021; Moffat et al., 2017; Public Health Advisory Committee, 2003). The project, therefore, aims to address a public health problem through exploring ways to promote co-design by using an existing educational framework for the adaptable lesson plan.

The adaptable lesson plan combines two objectives:

1. Promoting education about oral health and toothbrushing within an environment where children are located, such as schools, and within the existing educational paradigm, child-centred approach, and framework of the New Zealand Curriculum (Ministry of Education, 1999).

2. The adaptable lesson plan provides an example of a tool that teachers and adult facilitators can use in their teaching about oral health to promote collaborative group discussions, participation, and co-design opportunities (Ministry of Education, 1999). For children, the partnership and co-design element of the adaptable lesson plan creates opportunities for participation and contribution in discussions with the potential that their voices and advice can be implemented in their communities and possible oral health policy changes. This project opens the doors for future research with children in co-designing, PAR, digital opportunities, and prosumerism in oral health.

6.8 Researcher Journey Conducting this Research

Conducting this research has provided me with an exciting learning experience. However, in my journey, I learned that conducting research faces challenges that may force a change of direction. As indicated in Chapter 1, changes were needed because of unprecedented circumstances. For example, changes to the initial proposal because of lack of support from researchers in Vanuatu, difficulties in recruiting children from intermediate schools, COVID-19 restrictions, schools no longer willing to support the project, changing the group participants, difficulties in recruiting student teachers, changing supervisors, and having a fulltime teaching schedule all significantly impacted the direction of this project. However, I also learned that there are ways to overcome

these obstacles and to look for alternatives to achieve the goal. Despite these difficulties, this project has been a positive experience.

6.9 Chapter Summary

Dental caries in children continues to be one of the most common oral health problems in New Zealand. Despite the efforts of the COHS and school toothbrushing programmes to prevent dental caries, disparities and inequalities in dental care access still exist among children, in particular with Māori and Pacific Island children (Kanagaratnam & Schluter, 2021; Moffat et al., 2017; Public Health Advisory Committee, 2003). In addition, the inadequate COHS workforce, and ineffective toothbrushing programmes implemented in schools, raise questions about what alternatives there are that require less effort, less expense, and are more effective in the prevention of dental caries (Kanagaratnam & Schluter, 2021).

Children are gifted with creativity, and are curious and enthusiastic about everything they do and discover (Melonio & Gennari, 2013). There is vast potential to use these gifts in research with children using PAR to promote oral health. In addition, children, as great users, or consumers of the Internet, can use and manipulate digital technology in a way that allows them to modify what is produced to co-create new information (prosumers) and share it online (Gerhardt, 2008). This ability has the potential for children to promote their toothbrushing games to other internet users.

Findings of this research revealed a gap in conducting research with children in oral health. Children have the potential to be the primary researchers in oral health and to provide advice about how to prevent dental caries from their point of view and through co-designing a toothbrushing game. Promoting co-design in oral health will require support from school teachers and adult facilitators in partnership with oral health staff to inform practice and, using PAR as a way to provide ideas, to create a toothbrushing game.

This research also revealed that literature around using serious games created by or developed by children to promote toothbrushing and prevent dental caries is scarce or non-existent. Thus, this area requires further exploration as it could be an innovative and affordable option to promote daily toothbrushing and prevent dental caries in children.

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Appendices

Appendix A: Ethics Approval

Auckland University of Technology Ethics Committee (AUTEC)

Auckland University of Technology
D-88, Private Bag 92006, Auckland 1142, NZ
T: +64 9 921 9999 ext. 8316
E: ethics@aut.ac.nz
www.aut.ac.nz/researchethics

3 November 2020

Cath Conn
Faculty of Health and Environmental Sciences

Dear Cath

Re: Ethics Application: **19/285 Creating a space for participatory research with children from Pacific communities: The use of serious games or other fun tools and techniques to promote daily tooth-brushing using the internet**

Thank you for your request for approval of amendments to your ethics application.

The amendment to the data collection protocol (recruitment of student teachers only) has been approved.

I remind you of the **Standard Conditions of Approval**.

1. The research is to be undertaken in accordance with the Auckland University of Technology Code of Conduct for Research and as approved by AUTEC in this application.
2. A progress report is due annually on the anniversary of the approval date, using the EA2 form.
3. A final report is due at the expiration of the approval period, or, upon completion of project, using the EA3 form.
4. Any amendments to the project must be approved by AUTEC prior to being implemented. Amendments can be requested using the EA2 form.
5. Any serious or unexpected adverse events must be reported to AUTEC Secretariat as a matter of priority.
6. Any unforeseen events that might affect continued ethical acceptability of the project should also be reported to the AUTEC Secretariat as a matter of priority.
7. It is your responsibility to ensure that the spelling and grammar of documents being provided to participants or external organisations is of a high standard.

AUTEC grants ethical approval only. You are responsible for obtaining management approval for access for your research from any institution or organisation at which your research is being conducted. When the research is undertaken outside New Zealand, you need to meet all ethical, legal, and locality obligations or requirements for those jurisdictions.

Please quote the application number and title on all future correspondence related to this project.

For any enquiries please contact ethics@aut.ac.nz. The forms mentioned above are available online through http://www.aut.ac.nz/research/researchethics

(This is a computer-generated letter for which no signature is required)

The AUTEC Secretariat
Auckland University of Technology Ethics Committee

Cc: Daniel Fernandez; Manorika Ratnaweera

Appendix B: Participant Information Sheet

Participant Information Sheet

Date Information Sheet Produced:

10 November 2020

Project Title

Creating a space for participatory research with children from Pacific communities: The use of serious games or other fun tools and techniques to promote daily tooth-brushing using the internet.

An Invitation

Greetings, my name is Daniel Fernandez and I am a lecturer and researcher from the Auckland University of Technology. I would like to invite you to take part in a research study I am conducting in order to gain my master's degree in public health. The present research deals with the development of participatory tools and emerging technology within the context of dental caries (dental decay) and toothbrushing.

You are invited to participate in a research project to explore your ideas and creativity, using technology or tools (such as games, videos, or digital Apps) that can be used in your teaching. Your ideas could be implemented in your teaching to empower children to develop skills in co-designing serious games in oral health, in particular with toothbrushing. The children ideas and designs could be used to create an App, or a game using a smartphone to promote daily toothbrushing to prevent dental decay in children.

This study is coordinated by the Auckland University of Technology. Your participation is entirely voluntary (your choice). You do not have to take part in this study. If you agree to take part, you are free to withdraw from the study at any time and without giving a reason. To help you make your decision please read this Participant Information Sheet. If you have any questions regarding this invitation, or this study, please contact me.

Thank you very much.

What is the purpose of this research?

Dental decay (caries) in children from Pacific communities, living in Auckland, has become an important public health problem and oral health prevention, whilst relatively straightforward, is not widely adopted. Promotion initiatives are needed to improve children's oral health. Serious games, as a fun and creative way to combine gamifying with social problem solving, has become a focus of innovative research and development, with an increasing focus on the use of smartphones and the internet.

The purpose of this research is to explore how your creativity, using technology or tools such as games, videos, or digital Apps, can be used in your teaching. Your ideas and creativity will have the potential to encourage and empower children to become co-designers with the aim of acting as advisors or co-researchers to make decisions and contribute to constructions relevant to their lives and childhoods. The creation of serious games by children as a result of their empowerment as co-designers can be used in smartphones to promote daily toothbrushing to prevent dental decay in children. The findings of this research about how children are empowered in the classroom to participate and co-design activities may be used for academic publications and presentations.

How was I identified and why am I being invited to participate in this research?

My supervisor has approached the academic staff from the AUT Bachelor of Education Programme to invite final year students to participate in this study. As you are an undergraduate student, you are learning to become a schoolteacher and therefore there is the potential that you will be working with children. Your lecturers have given consent for you to be invited to participate in this research. You might also have seen and advertisement on the Child and Youth Health Research Centre website or Facebook page, or via Collaboration or Smart Cities research project.

How do I agree to participate in this research?

Your participation in this research is voluntary (it is your choice) and whether or not you choose to participate will neither advantage nor disadvantage you. You are able to withdraw from the study at any time. If you choose to withdraw from the study, then you will be offered the choice between having any data that is identifiable as belonging to you removed or allowing it to continue to be used. However, once the findings have been produced, removal of your data may not be possible. I shall provide you with a Consent Form where you can indicate your willingness to have your participation in this research on the day of the workshops, with participatory activities.

What will happen in this research?

If you decide to participate, you will be invited to take part in three workshops with other fellow students of your programme to provide ideas in the form of pictures, drawings, brainstorming, photographs, sketching, maps, charts, and role play. The workshops will be held in the AUT North Campus room AE109. However, should the country or university go into another COVID-19 lockdown, the workshop sessions might be conducted online through Collaborate or Zoom video conferencing.

Your ideas will be collected on cards and will be collated on a board for you and your fellow students to discuss and to decide what concepts are relevant to you. The workshops will be held in your faculty at a time and day that is convenient to you. This is likely to be between end of semester two and up to mid-December. The first workshop is an introductory workshop of one hour and a half in which we will introduce ourselves, do a practical exercise on using participatory methodology for this research, and doing a brainstorming exercise about the purpose of the study. In the second workshop (2 hours duration), you will be invited to participate in activities that will lead to creative ideas in your teaching to provide space for children to become co-designers. In the last workshop of hour and half, we will do an exercise summing up the ideas together. We will do a round up and post it collage of how your ideas have the potential to be implemented in your teaching and to create space for children to become co-designers in oral health. I will provide refreshments during these three workshops.

The activities you do in the workshops may be audio/video-recorded or taking photographs of the activities you do during the workshops. The audio/video recording or photographs will be conducted in a way that protects your identity. However, if you wish to use a phone or wish to video-record your ideas and creativity, it will be facilitated in a way that does not show members of the class. Any video recorded material of your fellow students' faces or other personal identifications will be removed and not used as part of the study. Instead, it is likely to show animation, or drawings, created by you.

What are the discomforts and risks?

There are no known discomforts or risks caused by this study. If you feel uncomfortable at any time, you can take a break from the activities, or simply stop participating. Taking part in this study will take some of your time, requiring you to answer some questions and participate in workshop activities to discuss how to empower children in codesigning toothbrushing tools that can be use in serious games.

What are the benefits?

Your will learn to work as part of a team to empower children to become co-designers and researchers to express their views and ideas in the form of serious games that can be used to promote toothbrushing in smartphones or other digital devices.

How will my privacy be protected?

Your will be doing these activities in class with your classmates. We will not include any of your personal information in anything we publish or present from this research.

What are the costs of participating in this research?

There are no financial costs nor financial compensation for participating in this research. The research study will require you to spent approximately 5 hours of your time in the following format. Workshop 1, one hour and a half, workshop 2, two hours, and workshop 3, one hour and a half.
The participation in this project can be used as part of your industry hours/ practicum experience hours. Refreshments for you and your classmates will be provided during the workshop activities.

What opportunity do I have to consider this invitation?

You will be given two weeks upon receiving of the Participation Information Sheet to consider the invitation. I shall do one follow-up after two weeks to know if you are interested in participating in the study.

Will I receive feedback on the results of this research?

A summary of the findings of the research can be emailed to you if requested in the Consent Form.

What do I do if I have concerns about this research?

Any concerns regarding the nature of this project should be notified in the first instance to the Project Supervisor, Dr Cath Conn cath.conn@aut.ac.nz, 921 9999 Ext 7407.

Concerns regarding the conduct of the research should be notified to the Executive Secretary of AUTEC, *ethics@aut.ac.nz* , (+649) 921 9999 ext 6038.

Whom do I contact for further information about this research?

Please keep this Information Sheet and a copy of the Consent Form for your future reference. You are also able to contact the research team as follows:

Researcher Contact Details:

Daniel Fernandez dfernand@aut.ac.nz

Project Supervisor Contact Details:

Dr Cath Conn cath.conn@aut.ac.nz, 921 9999 Ext 7407.

Approved by the Auckland University of Technology Ethics Committee on 3 November 2020, AUTEC Reference number 19/285.

Appendix C: Consent Form

Consent Form

Project title: The use of 'serious games' or other fun tools and techniques designed by children to promote daily tooth-brushing using the internet.

Project Supervisor: *Dr Cath Conn*

Researcher: *Daniel Fernandez*

- O I have read and understood the information provided about this research project in the Information Sheet dated 10 November 2020.
- O I have had an opportunity to ask questions and to have them answered.
- O I understand that videos and/or photographs will be taken in a way that protects my identity.
- O I understand that any photos or videos taken by participants need to be done in a way that protects the identity of my fellow participants.
- O I understand that identity of my fellow participants and our discussions in the workshop is confidential to the group and I agree to keep this information confidential.
- O I understand that notes will be taken during the workshop and that it will also be audio-taped and transcribed.
- O I understand that taking part in this study is voluntary (my choice) and that I may withdraw from the study at any time without being disadvantaged in any way.
- O I understand that if I withdraw from the study then, while it may not be possible to destroy all records of the workshop discussion of which I was part, I will be offered the choice between having any data that is identifiable as belonging to me removed or allowing it to continue to be used. However, once the findings have been produced, removal of my data may not be possible.
- O I agree to take part in this research.
- O I wish to receive a summary of the research findings (please tick one): YesO NoO

Participant's signature: .....

Participant's name: .....

Participant's Contact Details (if appropriate):

.....

.....

.....

.....

Date:

Approved by the Auckland University of Technology Ethics Committee on 3 November 2020. AUTEC Reference number 19/285.

Note: The Participant should retain a copy of this form.

April 2018 page 1 of 1 This version was last edited in April 2018

Appendix D: The Adaptable Lesson Plan

Table 4 *The Adaptable Lesson Plan – Example for Years 7 and 8 in a School Setting*

<table>
<tr><td colspan="2">Area of learning
Personal health</td><td>Year group
Years 7 and 8</td><td>Date/Duration of the activity
1.00 – 1.30 approx.</td></tr>
<tr><td colspan="3">Groups/Differentiation
Children will be invited to decide how they want to interact with each other.
Children may want to engage in small groups.
Children may want to participate with children of their same age, ethnic group, culture, language, gender, etc.</td><td rowspan="2">Resources
Children will be invited to bring games, toys, or other objects they want to include in their games.
The teacher or adult facilitator supports the activity by bringing:
Board/card games
Balls, hoops, string
Dice
Mobile phones, tablets
Internet access
Paper, colouring pencils, markers etc.</td></tr>
<tr><td colspan="3">Links to New Zealand Curriculum
Health and Physical Education Syllabus (Ministry of Education, 1999)
Health promotion
Personal health and physical development
Level 3, Strand A: Children will be invited to identify from their own experiences and use their language, factors that affect personal, physical, social, and emotional growth and develop skills to manage changes.
Children will be invited to identify from their own experiences and use language factors relevant to food and how these influence teeth.
Children will be invited to identify factors relevant to body care about hygiene, such as toothbrushing.</td></tr>
<tr><td colspan="3">Learning Intentions (Child determined)
Children will be invited to design the learning activity, set the session objectives and style, and plan the group work.
Children will be invited to collaborate to develop ideas about creating games that will encourage children to brush their teeth daily.
The teacher's role is to support children's design and interweave key vocabulary or ideas about oral health.
Children will be encouraged to ask questions to inspire them to develop their games.
Children will be invited to develop co-designing skills in oral health.</td><td rowspan="2">Key Vocabulary
Children will be invited to share and use key vocabulary for their games, such as:
Tooth decay
Black holes
Toothbrushing
Toothpaste
Flavours
Challenges, rewards, and incentives
Games
Co-design</td></tr>
<tr><td colspan="3">Success Criteria (Child determined)
Children will be invited to
Work collaboratively, using their chosen design, objectives, and knowledge.
Use information technology, diagrams, charts, and other forms of notation (e.g., mind mapping) to develop and present their ideas.
Use various book and non-book resources to promote research background material.
Consider the motivations and rewards for their games to encourage ongoing use.</td></tr>
</table>

Introduction (Child determined)

Children will be invited to

- **10 min**
  - Share their prior knowledge about their views and experiences with games and oral health.
  - Express their opinions about the importance of toothbrushing and games so they can personalise their games.

- **30 min**
  - Play a range of familiar games (virtual and non-virtual) and identify those they like playing and the features of the games that contribute to their enjoyment and learning.
  - Develop a list on the whiteboard of all the attributes they identify from the games they enjoy.
  - Develop an agreed list of critical attributes for games.
  - Discuss key game attributes that can be applied to a tooth brushing game.
  - Discuss how a game could be used to promote daily toothbrushing using the Internet.

Activities/Experiences – this is the least child determined set of activities

30 min

- Children will be invited to demonstrate toothbrushing from their experiences and share these.
- The teacher or adult facilitator's role is to share their experiences of toothbrushing and refer to some good examples of toothbrushing – explore additional ideas beyond those children suggest for the importance of preventing dental caries.
- Children will be invited to organise their group brainstorming and mind-mapping to develop ideas about possible games.
- Groups will be invited to use their generated ideas to develop and describe the outline of a potential game.
- Groups will be invited to select a way to present their potential game to the class (using charts, diagrams, information technology etc.).
- Group presentations with critical feedback will be invited to encourage further refinement and development of the concepts presented.

Key Questions

Children ask questions

- What games do we like?
- What are the key elements of a good game?
- If we were going to make an excellent game, what would be its key attributes?
- What games can we make with paper and pens?
- What games can we create with dice, balls, or hoops?
- Why is daily toothbrushing important?
- How can the game we just created/played inspire you to remember to brush your teeth every day?
- How can the game we just created/played be played on a device using the Internet?

Conclusion and Assessment – This aligns more closely with PAR	**Evaluation/Next Steps**
Children will be invited to ▪ Reflect on the experience and summarise what they see as successful about the sessions. Children may use post-it notes for reflection and their suggestions for improving sessions. ▪ Write reflective notes about how the lesson went and identified areas for improvement. ▪ Create their own game, present it to the rest of the class, and compare it with other games. ▪ Decide what game they created as a group is best for promoting daily toothbrushing using the Internet.	Children use the success criteria to evaluate the effectiveness of the toothbrushing game.