USING IMMERSIVE TECHNOLOGIES TO SUPPORT FOOD-BASED EDUCATION

A THESIS PRESENTED IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR
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Abstract

The use of Virtual Reality (VR) technology, combined with 360 degree images and videos, provides an opportunity for teachers to bring students into the classroom, even when they are not there. The possibility of immersing students into a virtual world could provide an answer to motivation and engagement issues for today's students as well as provide a solution to some of the current constraints facing teachers, such as in food-based education. With the rapidly reducing cost of equipment and the increasing quality of virtual experience, it appears virtual reality is on the tipping-point of becoming a regular part of school programmes.

With the changing pace of society and the ease of access to processed foods, the need for food literacy is more important than ever. Kitchens are a costly commodity for schools and the obvious health and safety issues make teaching practical cooking skills challenging. This thesis outlines the results of a qualitative study that explores how foods education is delivered in Christchurch and the current limitations, and based on the results of this field study, describes the design, development and testing of a virtual classroom environment that teaches food safety content. With a focus on student engagement and motivation, data is collected from observation of the use of the virtual classroom and a post-test survey. Results show that students were highly motivated, with all participants giving the highest possible score when asked if it was fun to use.

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1 - Introduction

Adults are becoming more and more drawn towards convenient, fast and often processed foods, (Shahri, 2014) and the same can be said of children and adolescents (OECD, 2017). On top of this, if the only food prepared in the house is convenience or packet food, children are not getting the vital modelling of effective food preparation that will allow them to cook in the future. This is highlighted by Jamie Oliver who claims;

> *I wouldn't say that processed food, ready meals and even takeaways aren't relevant to modern life, it's just that over the past 40 years there are three generations of people who have come out of school and gone through their home life without ever being shown how to cook properly. ("BBC - Derby, Jamie Oliver,")*

In the New Zealand Curriculum (Ministry of Education, 2007), the guiding document for all English-medium, state and state integrated schools in New Zealand, cooking or food related education is not significantly represented. The specific references exist within the health and physical education and technology areas of the curriculum. The majority of cooking in schools is covered at Years 7 and 8[1]where most students receive compulsory specialist subject teaching, including food-based education. The lack of access to suitable cooking facilities and current teacher shortages also mean the issue of food illiteracy is increasing.

At a time when foods education needs support, the potential of virtual reality (VR), technology that allows users to be immersed in an alternative world, interacting and exploring it as if it is real, offers a solution. The potential to use VR in education has become a reality with a range of affordable options that could allow access to all students. It may not be long until a VR headset is added to a student's stationery list and becomes a regular part of student life. The potential of VR as a learning environment is promising, Bodekaer (2015) in a study of Labster ("Labster | Award Winning Virtual Lab Simulations," n.d.) found it could actually double student achievement. This might be an ambitious target but VR is definitely something that provides a higher level of immersion than other technologies, offering huge scope for use in schools and, in particular, in specialist classrooms where the cost of equipment is prohibitive, and the teachers' ability to provide specific one-on-one teaching is limited.

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[1] Year 7 and 8 in New Zealand schools refers to the 7th and 8th year of schooling and is usually students aged between 11 and 13 years old. These students are sometimes referred to as intermediate because an Intermediate school in New Zealand is a form of middle school that only caters to students in Years 7 and 8.

Another way to foster engagement in cooking could be through the use of gamification, defined by Deterding, Khaled, Nacke and Dixon (2011) as "the use of game design elements in non-game contexts". Unlike game based learning that uses a game to teach, gamification involves applying game elements to the programme as a whole and adding things like scoreboards, points, challenges or quests (Ingwersen, 2015). Regardless of the intervention used with students, it could be enhanced through the addition of the motivational principles of gamification.

This thesis examines food-based education in New Zealand schools and investigates how immersive technologies can be used to improve current practice. The issues faced by foods based teachers, in Christchurch, New Zealand are examined through a number of interviews and a case study at one school. Potential technological solutions are explored and the development of a VR Classroom is explained. The thesis concludes by following a user study that explores the effects of the VR Classroom on a group of students.

1.1 Research Question

The following research questions were developed to guide this study:

> *How can immersive technologies be used to enhance food-based education in New Zealand secondary schools?*

In order to answer this question I will explore the following two sub-questions:

1. *What are the most important skills students need in a food-based classroom?*
2. *What interventions would be appropriate for this particular school?*

1.2 About the Researcher

This thesis records a study spanning from February 2018 to May 2019 at the Human Interface Technology Laboratory New Zealand, University of Canterbury. Since 2007 I have worked as a technology teacher and leader at a Christchurch Year 7 and 8 technology centre. In my role, I was not directly delivering food-based education; however, as a leader I was indirectly involved in the programme delivery.

I am currently employed as the leader of the Christchurch Technology Cluster, a cluster developed following the earthquakes in Christchurch to help build the relationships across the region. I am also a member of the Christchurch Technology Advisory Board a group reviewing how the Year 7 and 8 technology provision is delivered in Christchurch schools.

Whilst this thesis is new research, my previous knowledge and experience underpins my position as a researcher.

2 - Background

2.1 Cooking and Health

> *Teaching cooking literacy to children gives them a skill for life leading to better nutrition and thereby lowering the risk of health problems, which will provide a better positioned workforce and long term savings for New Zealand's health system. (Gorton, 2016)*

The ability to cook food is often accepted as fundamental to healthier eating (Caraher et al., 1999); however, I would argue that the lack of cooking skill limits the nutritional intake. Shahri (2014) highlights the clear divide between the food consumers of today and how the appeal of fast and convenient food is taking over from the slower process of preparing and cooking traditional foods. The negative effects of a convenience food society could be significant for both physical and emotional health. Steel (2011) claims "people who don't cook don't use local food shops, invite their friends around for dinner, know where food comes from, realise what they're putting into their bodies, understand the impact of their diet on the planet- or educate their children in any of the above" (as cited in Shahri, 2014, p.28).

The OECD obesity report places New Zealand as third to USA and Mexico, claiming nearly 30% of New Zealand adults are obese (OECD, 2017). Caraher (2012), however, claims there is no evidence to say that cooking skills lead to heathier eating. This being said, Gorton (2016) says that children who cook their own meals will eat 76% more salad than those who eat a meal prepared by a parent. I concur with Steel (2011) that being able to cook has numerous potential health and wellbeing benefits, and whilst there is a lack of research into the effects that cooking skills have on eating habits, it is clear that it is much harder to eat healthily without cooking skills.

2.2 Cooking in the New Zealand Classroom

When eating healthily is so important, food-based subjects in schools, I argue, are lightly represented in the The New Zealand Curriculum (Ministry of Education, 2007) and the latest update (Ministry of Education, 2017). This national curriculum provides a framework for schools to develop their own school programmes for students in Years 1-10. The curriculum

is broken into eight key learning areas and cooking is represented, in part, in two of these areas - technology, and health and physical education. There is however, one prescribed reference to practical cooking where it says "it is expected that all students will have opportunities to learn practical cooking skills by the end of year 8" (p.22)."

The opportunity to cook in schools is greatly restricted by the lack of access to suitable kitchen spaces. Traditional primary classrooms in Christchurch have no cooking spaces and if practical cooking is to be attempted with classes, it is prepared within the regular classroom, causing concerns around hygiene. The preparation may be completed in the classroom, but the actual cooking is usually completed by the teacher in the staffroom kitchen. New and recently renovated classrooms are being developed with a variety of learning spaces that include a kitchen. These Innovative Learning Environments (ILEs) are being adopted at a greater pace in Christchurch as a result of the damage caused by the major earthquakes of 2010-11, necessitating major repairs and a number of newly built schools. However, even in the recently developed ILEs, as shown in Figure 1, one kitchen unit with a singular stove does not cater well to a large number of students.

Figure 1- Te Waka Unua School, retrieved from www.tewaka.school.nz

A lot of work has been done in schools, in recent years, to promote healthy eating with the *Fruit in Schools* scheme (Ministry of Health – Manatū Hauora, 2017) and *Garden to Table* ("Garden to Table," 2019), an initiative that encourages schools to empower students to eat natural foods through planting, tending, harvesting, preparing and cooking foods straight from the school gardens (Collins, Richards, Reeder, & Gray, 2015). However, too often this is not the case and most of the food goes straight home with staff and students prior to cooking (Collins et al., 2015). This matches my personal experience. In my first year of teaching, students prepared, planted and cultivated a crop of new potatoes. However, with the end of year workload issues, the students took the potatoes home without having an opportunity to cook them.

Currently most of the cooking education in schools comes through the Years 7 and 8, technology education programmes. Historically called Manual Training, these opportunities allow students to learn in specialist practical classrooms including a kitchen. This cooking

opportunity, however, is not necessarily continued at secondary school where only a small proportion of students are enrolled in food-based subjects. Table 1 also shows that the number of students in food-based subjects at secondary school has also reduced from 17.14% in 2004 to 13.52% in 2017.

Year	Food Technology	Home Economics	Total	Total Y9-13 Students	% of Total Students Enrolled in Foods Subjects
2004	31,207	15,693	46,900	273,663	17.14%
2017	32,149	6,326	38,475	284,327	13.53%

Table 1 - Secondary students completing food based subjects, (Ministry of Education, 2018a, 2018b, 2018c)

The cost of providing and maintaining cooking facilities is significant and often the maximum hours the spaces are used for is less than 20 hours a week. Not only are the rooms expensive to maintain, they are single purpose spaces and cannot be easily used for teaching other subjects due to health and safety concerns around food contamination. Currently New Zealand has a known teacher-shortage with a recent survey by Long & Moir (2018) of 162 secondary schools showing that 40% of schools could not fill specialist teaching positions. When teaching positions cannot be filled, student numbers reduce, potentially, creating a catch-22 situation where schools are reluctant to spend money on maintaining kitchens that are not used to capacity.

2.3 Gaming to Gamification

Currently, in order to truly understand the power of games and the elements needed to fully engage students, it appears a close examination of Fortnite (EpicGames, 2018) is pertinent. King (2018) claims Fortnite is so addictive that boys are experiencing genuine withdrawal symptoms, causing concern for parents and teachers alike. The almost cult like game has had an effect on youth like no other, to the point where young people, who may never have played the game, search online to learn the dance moves of Fortnite avatars, in order to impress friends at school. If we put concerns aside and attempt to replicate a number of the key gaming elements that make Fortnite so popular in education games, the first barrier to learning, student motivation, could be solved.

Collaboration, I believe, is one of the most dominant features of Fortnite, including not just the ability to talk to peers while playing but also the ability to play games together, working in teams to win battles. There is also the capacity to get a group of friends together and

compete against others in 'Apex Legends', the new game based on the 'Battle Royale' principle This intense competition and social experience, I believe, can be likened to the feelings experienced through team sports or other competitive playground games like 'bullrush', a mass tackling game, described by Scotty Stevenson as "a kind of Hunger Games" (as cited in Slack, 2005). These same human desires for competition and social interaction are already being exploited by schools through common online learning games. The math game Prodigy ("Prodigy Math Game," n.d.) is one of these games that uses game-play, badges, pets and other motivational tools to entice children into learning maths. Like Fortnite, I have witnessed children using prodigy, outside of school hours, so they can stay in touch with their friends.

Serious games are defined by De Freitas (2006) as those "in which education (in its various forms) is the primary goal, rather than entertainment" (p.10). Educational games have the potential to develop learning when used under the right conditions. Gaydos (2015) highlights a need for a focus to go onto developing games for education, rather than developing games for research. While many features are known to increase motivation to play games, more research is needed to find the features that also enhance learning.

Bonde et al. (2014), in an experiment into the effects of a serious game ("Labster | Award Winning Virtual Lab Simulations," n.d.), reported that 97% of participants in the course using the game found it more interesting than the non-game course. The gaming elements like badges, problems, immediate feedback, choice, and self-efficacy, make 'A Crime Scene Lab' from Labster and 'Explorez' (Perry, 2015) effective. In 'A Crime Scene Lab' students locate clues and use the Lab to solve the crime. In 'Explorez' students use augmented reality to explore a university campus, learning and using French language skills as they complete the quest. Perry explains how they have attempted to go beyond extrinsic motivators to get students to engage with the content for long periods of time. For this reason, 'Explorez' uses a quest as a basis for the game, claiming that quest based education encourages students to learn well beyond the pass level (Perry, 2015).

Gamification is the process of using game motivators and applying them to non-game situations such as in the classroom or work place. According to Perry (2015) "gamification uses game-based mechanics and game thinking to engage people, motivate action, and promote learning" (p.1). Bolstad (2018) claims "Educators who take the time to dig deeper into games discover a wealth of ideas and possibilities to enrich their practice" (p.1), and a common way teachers are doing this is through adaptation of common games for learning, like the use of scavenger hunts, card games and quiz shows. According to Kapp (2014),

gamification includes a range of elements including competition, cooperation, points, avatars, levels, leader boards, chance, risk, aesthetics, rules and clear objectives. Gamification described by TKI (n.d.) also includes player control and the opportunity for mastery as core gamification elements. St Thomas of Canterbury College (TKI, n.d.) claims both the students and the teachers are motivated by gamified learning and that many at-risk learners are able to thrive when gamification is combined with hands-on projects.

2.4 Virtual Reality

According to Jerald (2016), "virtual reality is defined as a computer-generated digital environment that can be experienced and interacted with as if that environment were real" (p.9). This feeling of realism is reinforced by Curcio, Dipace, and Norlund (2016), who claim VR is at the highest end of the immersive spectrum. Burdea (n.d.) refers to VR as "I^3" claiming 3D Interaction, Immersion and Imagination as the keys to effectiveness.

Historically, quality VR has been unaffordable and restricted to specific areas of research and training. However, recent developments in technology are making VR accessible to the public through portable mobile device applications. Google Cardboard (n.d.) is one of the most famous products in this category but, in order to experience fully immersive games, the processing power of the cellular phone doesn't quite deliver the quality needed. High quality VR is, however, possible for under $1000 NZD through the use of the PlayStation VR, ("PlayStation VR | The VR gaming system for PS4 | PlayStation," n.d.). Other systems are available for use on a personal computer including; the Oculus Rift ("Oculus Rift | Oculus," 2018) and the HTC Vive ("VIVE™ New Zealand | Discover Virtual Reality Beyond Imagination," 2018). However, to work effectively the user will also need to have a high quality computer system with expensive graphics.

My first virtual reality experience is outlined in the anecdote below and highlights the potential power of this technology for education.

> *I had just finished the introductory lesson on the HTC Vive when my guide said, "I will show you something really cool, turn around". I turned around and an elevator door opened, I stepped in and took a ride to the top floor. When the elevator door opened I was 50 storeys up in the air with city scenes and noises below. A plank was sticking out of the door, over the street a long way below.*
>
> *My guide commented, "You probably know what to do now, just walk out and jump!"*

Surprisingly, as I looked down, I was scared. I tentatively took two steps onto the plank before stopping and saying, "I can't do it".

My guide responded saying, "Don't worry just jump off," but despite knowing it wasn't real, I couldn't. I had a go at reaching out with my foot to feel beside the plank but I was too scared of losing balance to put it down.

I stepped back into the virtual elevator and returned to the ground.

(Visit to VR Room, 16th May 2018)

It was at this stage that I saw and realised the immense power and potential of virtual reality. If the simple simulation that I was experiencing could feel that real, the ability to immerse students in learning that would otherwise be unattainable was obvious. Following the elevator ride, I explored the 'Gourmet Chef' role in Job Simulator (Valve Corporation, 2018), one of the most popular VR games suitable for children. This experience gave me a sense of how a kitchen simulation could be achieved but also showed how difficult it was to create realistic cooking VR.

According to Jin & Nakayama (2013), higher levels of adult learning are reported "when they participate in a workshop and get their hands around a piece of machinery" (p.16). For this reason VR is considered a great medium for training and is widely used in areas where the cost of training in real environments is either too expensive or too dangerous, including medicine and the military. Jin & Nakayama (2013), in their test of a VR workshop training exercise, claimed the VR method was at least as effective as a safety demonstration in the workshop. Smith & Ericson (2009), while examining the use of VR for a fire safety simulation, found students were highly engaged in what the authors describe as, normally, a mundane lesson. Lindgren (2009) compared students in a physics simulation on a computer to a full body simulation, and the results showed the whole body activity led to significant learning gains (as cited in Curcio, Dipace & Norlund, 2016). However, in Makransky, Terkildsen, & Mayer's (2017) similar study, one group of students used VR to complete a science experiment while the other group completed the same activity on a computer. The authors concluded the students in VR were more immersed but learned less than their counterparts, claiming VR simulations may be too distracting.

2.5 360 Degree Video

360 degree video and photos are images that allow the user to rotate around and look at a scene from all angles. The content can be viewed on a screen by scrolling or in a VR headset

allowing the user to turn around and view the image as if they were there. With the quality of 360 degree cameras rapidly improving and the ability of 360 degree video to give students a greater feeling of presence in the environment than traditional video (Harrington et al., 2018; Johnson, 2018) the ability for 360 degree content to enhance food-based teaching is apparent. The current top ranked 360 degree camera for non-professional consumers, 'the Insta360 One X' (Digital Camera World, n.d.), is capable of recording 18MP still images and 5.7K resolution videos, and is currently available in New Zealand for under $800 NZD. Combining the resulting footage with a cost effective VR headset makes bringing high quality 360 degree video into the classroom realistic.

In the next chapter, I explore foods education, including the limitations of and potential opportunities for an immersive technology intervention.

3 – Field Study

Following on from the background in Chapter 2, this chapter attempts to answer the following two sub-questions:

1. *What are the most important skills students need in a food-based classroom?*
2. *What interventions would be appropriate for this particular school?*

This chapter has two parts, interviews with teachers and a case study. Firstly, I discuss an interview with four specialist foods teachers that attempts to establish the issues in food-based education and, specifically, to identify the key skills students need to thrive in a foods classroom. Secondly, I outline a case study in a Christchurch school exploring the day-to-day life of the foods teacher while contemplating how immersive technologies could be used at their school.

3.1 Interview

3.1.1 Methods

According to Markopoulos, Read, MacFarlane, & Höysniemi, (2008) interviews have the potential to provide a richer level of data, by allowing the conversation and stories to give a much clearer picture than a survey could.

In order to get what we need from an interview:

> *It requires that we interviewers keep our egos in check. It requires that we realise we are not the centre of the world. It demands that our actions as interviewers indicate that others stories are important (Seidman, 2013, p.9).*

When I started the interviews I had a good understanding of technology education; however, I lacked the fine understanding of what makes a specialist foods classroom successful and it was therefore pertinent that I heed the words of Seidman(2013), and truly listen.

This interview process, described as interpersonal, not fact finding by Cohen, Manion, & Morrison (2018), allowed me to listen, and observe not only to what was being said but also to observe and read between the lines, and probe as required to allow deeper responses to occur. On top of the visual and aural data that the interviews provided, by visiting the schools I was able to put the discussion into context and gain a deeper understanding than a paper survey could have provided.

On top of attempting to establish the key foods skills and attributes students needed to learn, I also wanted to understand any limitations that might affect the teacher's ability to enable this learning to occur. I developed a number of questions that formed the bulk of an "Interview Protocol" (Creswell, 2012). An interview protocol is described by Silverman (2010) as the planned questions for use in the interview, but both Creswell (2012) and Silverman (2010) share examples of how these have been combined into an interview sheet that acts as a guide, including notes and prompts to guide the interviewer. My interview protocol shown in Figure 2 includes key features for the interview highlighted by both authors, ensuring I introduce who I am, explain the aims of my research and remember to revisit the information in the consent forms.

INTERVIEW PROTOCOL

Project: - Using Immersive Technologies to Support Food Based Education
Time of Interview:
Date:
Place:
Interviewer:
Interviewee:
Position of interviewee:

- Thank you for your time,
- Introduce study - My study is based around the use of immersive technologies to enhance foods based teaching.
- Explain proposed stages of study interviews to gather key skills, case study to explore school and product evaluation
- Revisit information sheet key points - Confidential to me and supervisors, will not identify name or school, securely stored,
- I would like to record this interview and request your permission to do so.
- Do you have any questions about the process before we start?

Give time to read the information sheet and sign form, if required.

1. Please tell me about your job as a foods teacher?

2. Can you give me a bit more detail about the students you teach for example their age, gender, socio-economic background, cultural make up

3. What practical cooking skills do you believe a student needs to have to succeed at secondary school?

4. What other skills/attributes will a student need?

5. What are some of the teaching strategies/techniques you use to help them achieve these skills/attributes?

6. Please describe any restrictions or limitations that might prevent the students from gaining these skills/attributes?

7. Obviously you are passionate about your subject. With rapid technological changes, how do you see foods education changing in the future?

8. Can you think of ways immersive technologies could be used to enhance your programmes?

9. Have you had any experience with full immersive technology like VR, (Show a headset) partial immersion like Augmented Reality (AR) apps that allow you to look through your phone and see things overlaid on the screen, or Simulation games, games where you perform tasks that simulate the real world?

10. Give explanation on back, show headset, AR, (Google Translate, Pokemon GO)...Can you think of ways that these sorts of technologies could be used to enhance your foods programmes?

11. What do you think would be the limitations on using immersive computer based technologies at your school?

Thank you for taking the time to meet with me and share your thoughts on food education.

Figure 2 - Interview protocol

3.1.1.1 Ethics Approval

Prior to approaching interview subjects, my low risk Ethics application [Appendix A] was approved by the Director of the Human Interface Technology Lab NZ and this was

subsequently accepted by the University of Canterbury Educational Research Human Ethics Committee (Ref: 2018/05/ERHEC-LR) [Appendix B].

3.1.1.2 Selection of Teachers

I approached local schools seeking specialist foods teachers with recent experience teaching Year 7-10 food classes. I contacted a former subject advisor as well as a subject association leader seeking names of foods based teachers in Christchurch. Once identified, I made contact with teachers, via email, asking if they would be willing to be a part of the study and consequently confirmed an interview time. I included the information sheet and consent form for them to read and consider prior to the interview.

3.1.1.3 Structure of Interviews

Whilst each of the interviews varied, the goal was to follow a similar format. When we met, I repeated much of the information in the information sheet and sought permission to record the interview. I then started the interview with an open question that asked the teacher to describe their roles. Throughout the interviews I chose to use notes sparingly heeding the recommendation from Josselson (2013) who claims it prevents the interviewer from hearing the full story and causes the participant to wonder what you are writing. This view was challenged by Creswell (2012) who strongly advises note taking, including taking a pause for a few minutes after each question to allow for writing up notes. Robertson (2005) promotes active listening as one of the keys to effective dialogue. Active listening is where one focuses fully on the listener, attempting to put oneself in their shoes. This process of deep listening is also supported by Seidman (2013) who encourages researchers to review their interviews, making sure they are speaking a lot less than listening. Seidman, however, promotes note taking as a means to help with the listening. Unlike Creswell (2012), this means noting a word or two to follow up on, allowing the author to free their thoughts and fully focus, and thus preventing a loss of focus by attempting to remember something of interest. Josselson (2013) asserts that it is better to be reminded of an important name or detail than to miss other information by losing focus as you write, and I believe that by adopting Seidman's limited note taking, I was able to do this. To give me confidence that I could operate without copious notes, I recorded the interviews on two separate devices.

Other techniques I adopted to enhance the quality of interview included, memorising the questions and order of questions prior to the interview (Creswell, 2012), using probes and repeating of information to encourage clarification, and practising before the interviews, (Creswell, 2012; Josselson, 2013; Seidman, 2013). I offered participants the opportunity to

ask questions prior to the interview to help relax them (Josselson, 2013) and attempted to avoid judgement (Creswell, 2012; Josselson, 2013; Robertson, 2005). Avoidance of judgement good or bad, was an interesting aspect and one that Josselson (2013) cautions strongly against because the interviewees could wonder why they are not receiving positive responses for further comments

3.1.1.4 Analysis of Interviews

Seidman (2013) explains that analysis of interviews needs to be an inductive process, that is, the process should look at the data and at what interviewees are saying and not look at the data trying to prove a pre-defined hypothesis or theory. Seidman also suggests that the process of breaking down the data can begin with bracketing or highlighting parts of the text that the researcher feels have significance. I labelled the data with single words or phrases, then compared this across transcripts for repeating themes. Lichtman (2011) suggests coding the data claiming "the interview transcript is read line by line and paragraph by paragraph, looking for anything and everything that seems potentially relevant" (p.65). To do this, after transcription I read through the transcripts making notes as different issues stood out to me. I took a short break and then re-read the transcripts again looking at key themes and also highlighting any powerful quotes that the participants had made. With my research sub-question in mind I then read through each transcript to highlight the skills and attributes that the participants identified as being important for success in secondary school. This made the themes that were shared by the participants much easier to see. I used a similar process to identify the teaching strategies and the limitations identified by participants.

3.1.2 Findings

The focus of the interviews was to answer the first research sub-question: "What are the most important skills students need in a food-based classroom?" To do this I interviewed four specialist foods teachers including two working in a secondary school setting, and two working specifically at Years 7 and 8. One of the secondary teachers also taught Year 7 and 8 students as part of their role. All of the teachers interviewed were experienced classroom teachers who had taught foods education at a range of levels for at least ten years. There was one male teacher and three female teachers interviewed. After four interviews, I noticed a range of themes and codes recurring and no new ones appearing, so I concluded data saturation had been reached.

3.1.2.1 Practical Cooking Skills

My question asked: 'What practical cooking skills do you believe students need to have to succeed at secondary school?

> *That's my goal, that they feel good about what they are eating and that they can see the practical applications; that they don't have headaches in the afternoon because they haven't drunk enough, that they are not being told off because they haven't eaten enough in the morning and making sure that they are having breakfast and lunch. (Participant 1)*

The response shows that the depth of learning a food-based teacher is trying to teach goes well beyond that of cooking skills. While some of the teachers gave me skills, as a response to this question, the focus of the teachers was not on specific skills, but on giving students the capacity to eat well, be safe and contribute to the wider community.

From the interviews I identified four themes that were common across the participants:

1. nutrition
2. health and safety
3. cooking meals
4. design.

Whilst not the practical skills the question asked for, this is where the teachers wanted to go first, so I have reported it in the same way.

3.1.2.2 Nutrition

Nutrition was mentioned by all participants in a range of forms including understanding the effects of food on health, nutritional knowledge, effects of nutrients on the body, wise food selection and understanding fat, salt and sugar content. Two participants made a point of explaining how their programmes either completely excluded treat foods or were restricted to one sweet lesson at the end of the programme. Participant 1 explained that "if the last time they do food tech is with me, then, I've got a big job - to give them as many skills as I can, and a good knowledge about healthy nutrition". This is reiterated by Participant 4 who states:

> *When you are dealing with children you need to be giving the children a healthy food message. I can't get myself away from that. I can't go into the full design, technology side; I am still a bit traditional and teach food and health and nutrition.*

3.1.2.3 Health and Safety

Health and safety was the second most prevalent theme and this can be further broken down into hygiene and physical safety. All participants mentioned health and safety in some form including codes of practice, basic food hygiene, high risk and low risk foods, cutting skills, and oven and stove top safety. Participant 3 highlighted the importance of hygiene stating "they need to have a really good grasp on hygiene, because we obviously need to keep them safe, including, we want their food to be safe, so we look very carefully at that". Participant 2 clarifies by saying "Knowledge of food safety is a big one, whether that is critical food control, cross contamination or food storage". Participant 3 highlighted the need for students to understand physical safety and feel safe in the classroom. This is carefully planned for with a programme that starts with lower risk activities, builds new skills off the previous ones and scaffolds learning to ensure the students experience both safety and success.

3.1.2.4 Cooking Meals

Cooking real meals, or "proper meals" as described by Participant 4, was a recurring theme. Motivation for all teachers appeared to be developing students who would "go home and contribute to family meals" (Participant 3). The types of programmes being offered included a range of snacks as well as full meals. Some of the foods mentioned included toasties, sushi, pasta, nachos, pita pockets, fried rice, smoothies, bread, healthy burgers, scones, potato bakes and picnics. Whilst the goal is to teach real meals, the capacity to deliver a full meal within the timeframes in the lessons is a challenge. In order to succeed within the time constraint, some teachers teach the meal in parts and then combine them into a one off event at the end of the term while others focus on manageable meals and snacks that are achievable in the short lesson times.

3.1.2.5 Design

All of the participants mentioned design in their interviews with culinary design, design of products, design brief and food design discussed. One participant used 3D design software for students to demonstrate their food designs. Whilst design was a recurring theme, it wasn't obvious that it was a focus for all participants and could well have been a reaction to my technology teaching background. The Year 7 and 8 teachers tended to include some design at the end of their courses whereas at secondary school level there appeared a higher emphasis was placed on design. In part this was likely to have been because the secondary teachers had theory based lessons or non-practical lessons that were completed away from

the kitchen, while the Year 7 and 8 specialists had a smaller amount of contact time with the students and each lesson included a practical cook.

Other skills raised included learning about labelling and the legal requirements that surround foods. Three participants mentioned teaching the science behind foods including how they change as they are cooked, the properties of foods and the science behind nutrition. The need to purchase food in season and strategies for creating economic meals was also raised, as well as helping students understand where healthy foods come from.

3.1.2.6 Practical Skills

Whilst I had trouble getting teachers to identify the specific practical skills students need to learn, a number were discussed and I have displayed these in Table 2. When reading through these skills I identified three categories that capture them - preparation, cooking and cleaning.

Preparation	**Cooking**	**Cleaning**
Grating Slicing Dicing Washing vegetables Technical measurement Chopping	Boiling Baking Grilling Roasting Microwaving Adjusting temperatures Top of stove Using a blender	Cleaning up Washing Cleaning up routines Dishes in correct order

Table 2 - Key practical skills raised by teachers

3.1.2.7 Other Skills and Attributes

Whilst many of the skills discussed in the previous section could fit under the heading of 'Other Skills and Attributes', when asked what other skills and attributes students needed the participants all either mentioned the key competencies directly or listed a whole range of skills that fitted within the key competency framework. The New Zealand Curriculum (Ministry of Education, 2007) includes not only the core learning areas but also the key competencies that all students are required to learn. These competencies are:

- thinking
- relating to others
- using language symbols and texts
- managing self
- participating and contributing.

Table 3 shows the teachers responses cross referenced against the key competencies.

Key Competency	Participant 1	Participant 2	Participant 3	Participant 4
Thinking	Having a social conscience	Questions what and why they are learning	Thinking skills	Understand global issues with food
Relating to Others	Work collaboratively	Get on with others Relate to others Can be assertive	Listening skills Work collaboratively	Work in pairs
Using Language Symbols and Texts				Literacy skills Writing skills
Managing Self	Motivated Prepared to try new skills Self-awareness Risk taking Practice at home	Adapt to situations Work under pressure Time management Be assertive (not passive)	Independent thinkers Self-management Efficient use of time Growth mind-set	Independent skills Initiative Resilience Positive
Participating and Contributing	Having a social conscience Giving to others	Socialisation of food	Worthwhile citizens Contribute to the family meals	Understanding needs of others

Table 3 - Other skills and attributes raised by teachers

There was an emphasis on managing self with skills like risk taking, working under pressure, time management and having resilience being cited. The ability to work under pressure and manage time whilst not specifically mentioned by all participants was an obvious priority as preparing, cooking and cleaning up food takes time, and is not necessarily something that is suited to a short lesson that is potentially only 50 minutes long.

Relating to others was mentioned by all participants in some way. This included getting on with others, working collaboratively and working in pairs. Participant 2, however, highlighted a key point about relating to others saying, "it doesn't necessarily mean being subservient; it means assertive enough to do your share but expect others to do their share and be a little bit bossy if needed." Another area highlighted by Participant 3 was listening skills. This could be considered a managing-self skill, but because the essence of listening involves taking on the perspective of others, I have chosen to position it within the competency relating to others.

The area of participating and contributing was another area teachers highlighted. As mentioned earlier, all teachers wanted their students to be able to cook meals at home. Participant 1 had a genuine focus on building towards projects that are about contributing to others, including developing food for a junior class picnic and developing food parcels at Christmas time. The following quote emphasises the power of contributing, explaining why the students are expected to donate a certain portion of their food to charity.

> *They take great pride in it and what they love most is that they are helping and that they can go to Aviva and they can see that what they bring makes a difference. Even if they can't solve everyone's lack of food, they can do some, and that's their motivation. (Participant 1)*

Other areas raised were socialisation of food, creating worthwhile citizens and developing an understanding of the needs of others.

Thinking skills were another focud for all participants. Participant 1 talked about how he/she wanted students to make decisions based on a social conscience. Participant 4 enabled discussions that focused on global food issues and Participant 2 wanted students to develop the skill of asking why, explaining that whilst it is a pain for the teacher, students should expect a lesson to have a clear purpose and want to know why they are learning it. Only one teacher mentioned using language, symbols and texts.

3.1.2.8 Teaching Strategies

When asked what teaching strategies they used to help students to learn the key cooking skills, Participant 2 responded that he/she used "huge amounts of teacher led demonstrations, huge amounts". This was mirrored by the other participants who used demonstration as the key teaching strategy in the kitchen. Participants 2 and 3 both explained that demonstration was effective because there was a lot of visual learners and it particularly supported them. They also mentioned giving the students something tangible to work with; this was through the feel, smell or taste of ingredients or through the handling and reading of the recipe as they watched the observation.

The use of demonstration was closely matched to the provision of practical hands on cooking activities. Each teacher used a large range of cooking activities, maximising the time in the kitchens with practical cooking. In the Year 7 and 8 classes there was an expectation that the students would cook in each lesson, but, in the secondary school there was more of a mix, forced in part by the availability of rooms and the need to complete the theory components of the programme. Trying to fit in the paperwork aspects of the course was a common

frustration for participants. Participant 2 claimed to be breaking the mould a bit saying "I've put, in some cases, the paper on the back burner and put more emphasis on the practical learning".

The third area, highlighted by three participants, was the need for carefully thought out and taught routines as well as very structured planning. The students are taught a range of routines, especially when it comes to cleaning up. Participant 4 talked about the dishes routine while Participant 3 had a range of duties that students learned and then rotated around. The need for routines was justified by Participant 3 who claimed "if you just leave them to go on their own without some structure it just turns into chaos". Alongside the routines for students was the need for foods teachers to be particularly well organised and prepared for lessons.

A range of other teaching tools were mentioned including the use of workbooks or worksheets to teach theory components. Two teachers specifically mentioned asking questions, and two others mentioned the deliberate act of getting students to work in groups or pairs. Two teachers also explained how they used girls to support boys with the practical tasks. Participant 3 specifically mentioned scaffolding the lessons, carefully monitoring individuals and supporting them if they were struggling. Participant 1 also mentioned the use of field trips to local food manufacturers.

3.1.2.9 Restrictions or Limitations

I specifically asked teachers to explain any limitations that could affect the students' ability to learn. The participants raised some clear themes: a lack of time for food education, the difficult nature of the classes, a lack of time for teachers and a lack of space.

The one thing that was prevalent for all participants was *a lack of time*. A lack of time in two ways, the time in lessons and the time overall spent with the students. With lessons ranging from 50 to 90 minutes, the teachers experience a lot of time pressure. Unlike other curriculum areas or even other technology areas, the students can't just pack up their work and return to it the next week. In foods, they need to complete a set amount of tasks each lesson. The need to prepare, cook, clean-up and sometimes eat food within a finite time means that "foods is a pressure point" (Participant 3).

The second area mentioned by participants was the *difficult nature of some classes*. This varied between participants, but included a growing number of eating disorders, food allergies, high numbers of boys, special learning needs and disruptive behaviour. The term "difficult classes" was highlighted by Participant 4 as problem behaviours and large numbers.

Participant 3 elaborated further, describing issues with large numbers, a high number of learning needs and learner anxiety issues that they attributed to the learners having experienced the Christchurch earthquakes. Another issue raised by both Participant 1 and 3 was the safety issue of students with high learning needs attending foods classes without learning support.

All participants mentioned that they would like to use online video content in the classroom, but cited a *lack of non-contact time and technical capability* as the reasons for not realising this goal. Participant 3 talked about how video could be used as a check-in for students if they were absent or wanted to review content they were unsure of. Participant 4 talked about how another teacher had used online videos to allow students to pre-watch content prior to attending class.

The fourth issue was one of space and while it was not mentioned directly by all participants the issue of *a lack of learning space for foods education* is obvious. The capacity to deliver foods education in one kitchen, designed for 20 students, to over 650 students indicates that physical kitchen space is an issue. In one secondary school, some students have one practical lesson for every three lessons in the course due to a lack of access to the kitchen space. Some other concerns relating to space included a lack of wall space for display of students' work, no dry spaces for students to do paperwork or use digital devices, no teacher preparation area, and no storage for teacher resources.

Other limitations mentioned by participants included non-supportive leadership (two participants), a lack of trained foods teachers, a lack of communication between the classroom teacher and the foods teacher, too much change without suitable professional development or time allowance for teachers to adopt, and pressure to complete curriculum content that goes against the teacher's moral purpose. One statement of interest was the claim that, at secondary school, foods can be considered a soft option and therefore one that doesn't attract the most academic students.

3.1.2.10 Ideas on the Use of Immersive Technology

Among the participants, there was limited experience with using games, virtual reality or augmented reality in the classroom. As noted above, each of the teachers mentioned how they would like to incorporate more online video content into their programmes but little thought had been given to how other technologies could be used. All participants agreed that immersive technologies could be popular with the students and said that if it was going to improve learning they would like to give it a go. The following quote mirrors the general

feeling of the participants. "I guess if VR or something is going to bring it [foods education] to life a little bit more, then go for it. It might meet our kids; the kids do like new things. They do like the latest and greatest – they do like gadgets" (Participant 4).

Specifically, teachers suggested technology could be used to bring things to life, like this example of how it could enhance a pasta unit. "If they could put on some headsets and it took them to Italy so they could get the feel of what it is like to be there, I think that would be very helpful to set the scene for kids. They might see a real Italian chef making the pasta and then we do it in class" (Participant 3). This was suggested as a way to replace the guest speakers they have used in the past. Participant 4 thought it would be helpful if students could virtually visit a farm and see how the food is grown, while Participant 2 thought it would be useful if the students could work in a virtual kitchen and do specific tasks like cleaning or finding hazards. Other potential areas where immersive technologies could enhance were learning about water temperatures and managing high risk foods. It was highlighted that online games and activities that supported what they were teaching would be beneficial. Concern was raised, however, about having time for teachers to learn and implement new technologies in the classroom.

Slightly outside the scope of this project, two participants mentioned a need for an app or digital tool that allowed for easy processing and storing of students' work. This could be for the purpose of reporting, or for student assessment portfolios.

Participant 2 thought digital technology could be used to improve some of the low level worksheet activities some teachers are using, describing a 1970s worksheet with a satirical workplace and multiple hazards showing, where students need to identify the hazards. It was felt that the activity was very low level and that it would be great to have something that brought this type of activity to life.

3.1.3 Discussion

All of the teachers appear to be driven by something more than just teaching cooking skills, and the goal appears to be the creation of worthwhile citizens who are able to contribute to family and society. Unfortunately, the pressures of time and curriculum requirements make it hard for them to fully achieve this goal. All participants showed a desire to give the students as much skill, knowledge and experience as possible in the time they had them in their rooms. The pressure to complete curriculum content at the expense of this higher moral purpose was apparent.

The more the interviews evolved, however, the more the issue of time become evident. Wherever there was a potential deficit, the cause could likely be attributed to time. Time is a considerable factor, with some schools having a ratio of around one kitchen for more than 650 students. This high ratio of students to class space means that teachers have a very limited time with each student in the kitchen, with actual times ranging from 13-40 hours over a two year period at Year 7 and 8. At secondary schools, the students had more time with a specialist teacher; however, the time in the specialist classroom was less. In one secondary example the Year 7 and 8 students had 26 compulsory foods lessons, but only 13 of these were in the kitchen, equating to less than 13 hours of compulsory, practical cooking lessons over two years. The depth of curriculum coverage that can be achieved in this short amount of time is limited.

For Year 7 and 8 specialists, the ability to deliver personalised learning is seriously restricted as, effectively, the teachers are teaching the students for less time than a regular primary school teacher would see them in the first three to four days of the year. This rapid turnover of students, approximately 600 a year for the Year 7 and 8 teachers is extreme, and limits their ability to get to know students, to understand their prior learning, to develop rapport, to understand specific learning needs, and accurately track student progress. With a maximum contact time of 15-26 hours a year, regular teaching methods become problematic; just learning all of the students' names is difficult, ensuring all students' needs are catered for is potentially unattainable. The difficulty of not knowing the students and the transfer of student information between the regular classroom and the specialist teacher is highlighted in the following quote:

> *They [the teachers] can write this [student learning information] down for us at the start of the year, but children change. We need to know about the children throughout the year. They are quite different in the middle of the year. They will be quite different at the end, so I think that technology staff, they do a bloody good job, because suddenly with all these children, who they have never met, they manage to stay on top of the modern day curriculum (Participant 3).*

Managing Self, one of the key competencies identified in the New Zealand Curriculum was an area emphasised by all participants. This could be due to the fact teachers are working under such time pressure and students need to learn to manage themselves in order to succeed in lessons as short as 50 minutes. The area of participating and contributing was highlighted as important, but the ability to focus on this area was limited by both time and curriculum/assessment conflicts. There was only one participant who raised the competency, using language, symbols and texts. In a kitchen with specialist equipment and its own unique

language, I would have expected this to be a focus for teachers. Perhaps it is so fundamental to what they do that the teachers did not see the need to mention it, or again, it could come back to the conflict between curriculum and time, and there just is not the capacity to do the key competencies justice.

It is commonly believed that whole class lecture is not an effective teaching method. McLeod, Fisher, & Hoover, (2003) list a number of limitations including; the attention span of the students and a lack of interaction for the students. Added to this for a foods practical lesson is the potential inability for some students to be able to clearly see all aspects of the demonstration. This being said, all participants highlighted the use of demonstration as a key teaching strategy. The demonstration method combined with a lot of practical cooking work is, I believe, necessitated by the pressure to finish practical cooking in such short lessons. Muijs & Reynolds (2011) supports the use of whole-class teaching methods claiming:

> *there are several reasons why this whole-class approach is more effective than individualized learning approaches. One of these is that studies have found that whole-class teaching actually allows the teacher to make more contacts with each individual pupil than individual work (p.38).*

In order to be effective, the authors note that the demonstration needs to be followed by an opportunity for students to practise and teachers need to use this time to support and provide feedback on the students' ability to master the new concepts. In essence, this is exactly what the foods teachers do with their focus on demonstration and practical work. The demonstration followed by practical lessons also fits well with the thinking behind the traditional VAK model, as discussed by Willis (2017), that places learners into categories of *visual*, *auditory* or *kinaesthetic*. The demonstration provides visual and auditory lessons while the practical allows for the kinaesthetic learning to occur.

The question has to be asked though; if the teacher is predominantly using whole group demonstration followed by a practical lesson, what are the students who have already mastered those particular skills actually learning? With the OECD ILE project, the focus of the Innovative, Learning Environments lists seven key principles of learning and the first of these is 'Learners at the Centre'. "This calls for a mix of pedagogies, which include guided and action approaches, as well as cooperative, inquiry based and service learning" ("Appendix 2: OECD ILE project | Education Review Office," 2016). I certainly concur with the foods based teachers that when the time in class is so short, it is often more efficient or effective to do whole class, group teaching or demonstrations to attempt to reduce the

amount of time spent repeating the same instructions and best allow the students to experience success. But, the question still remains is it the best way?

The use of technology in the classroom should be used to transform learning, not just replace existing forms of learning with a device. All of the teachers mentioned wanting to use more digital media like YouTube videos in the classroom. The use of video to replicate teacher demonstrations however, is not an efficient use of technology on its own. If we look at the SAMR model shown in Figure 3, a matrix widely used to encourage teachers to use digital tools effectively, we can see four areas: Substitution, Augmentation, Modification and Redefinition (Puentedura 2006, as shown in Hamilton, Rosenberg, & Akcaoglu, 2016). The challenge is to create and use digital activities that allow us to transform the way we teach and students learn. This can be achieved by developing activities that go beyond substitution and augmentation to the areas of modification and redefinition (Romrell, Kidder, & Wood, 2014).

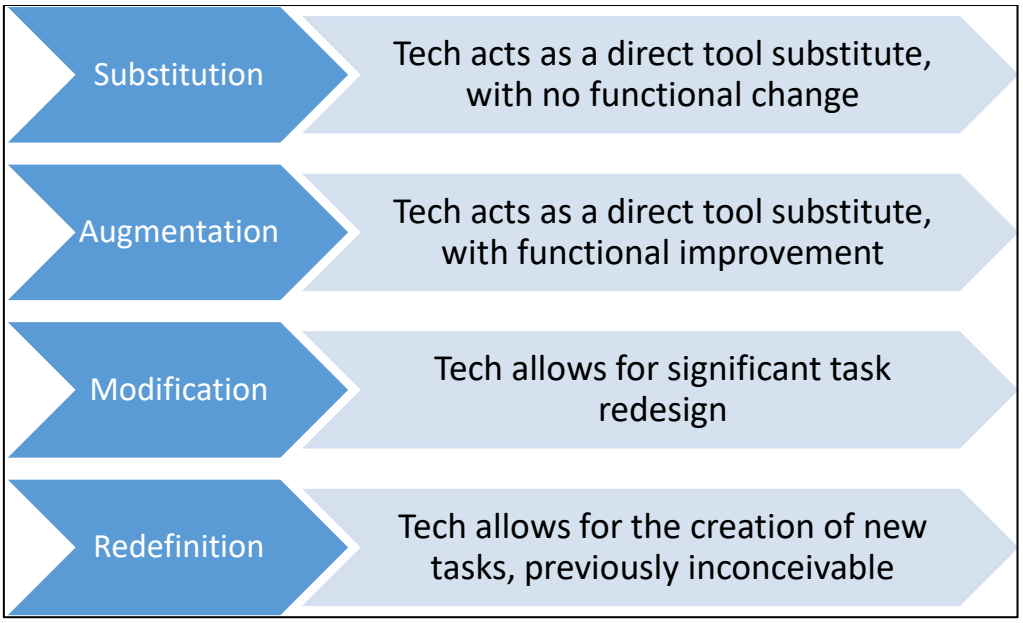

Figure 3 - SAMR Model based on Puentedura (2006) as shown in (Hamilton, Rosenberg, & Akcaoglu, 2016)

The SAMR model came to mind following a discussion with Participant 2 about the old-fashioned hazards worksheet that they referred to as "pretty low level". The SAMR model challenges us to go beyond just substituting the paper activity with a digital version. The use of technology allows for and should incorporate deeper levels of learning and provide benefits to the student, the teacher, or both, otherwise why change? In the case of the safety worksheet, instant feedback could be added, providing students with instant feedback about whether they have located the correct answers. Feedback is accredited by Hattie (2003) as

having the highest impact on student learning and is something that students do not get through the paper version of the worksheet. Likewise, assessment data can be made available to the teacher instantly, allowing them to modify the lessons as required. With the number of students foods teachers are facing in a week, the time for quality feedback is very limited and digital tools have genuine potential to improve in this area.

Flipped learning, as discussed with Participant 2, is an approach that takes the bulk of the teacher delivered lectures and makes them available online for homework, freeing up lesson time for greater face to face contact with students, hands on activities and individual scaffolding (Kostaris, Sergis, Sampson, Giannakos, & Pelliccione, 2017). All participants mentioned using videos in the classroom, and whilst this has benefits the straight substitution of teacher demonstration with video is of limited value. If the videos are used as a check-in point when students are struggling, or have missed a lesson, as discussed by Participant 3, the learning could be improved but if the videos were incorporated into a learning system like Vizia ("Vizia," n.d.) or EDPUZZLE ("Edpuzzle," n.d.), tools that encourage thinking and aid comprehension through the addition of quizzes and feedback, then the videos could be used to truly enhance learning. As part of a flipped classroom, the students could potentially view the lessons in their own time, at home, during the theory lessons or during other study time at school. With the inclusion of a built-in assessment tool the students could self-monitor their understanding and focus on lessons that they need to learn, avoiding wasting time on concepts they already understand. This could make classroom learning time more efficient, maximising student centred learning time in the kitchens. Students could potentially come prepared to cook and not need to sit through the demonstrations at the start of lessons.

One concern for teachers with letting go of demonstration is that they would lose this opportunity to teach the specific safety issues for each of the skills. If the teachers are no longer completing demonstrations with all students, the capacity to highlight these safety aspects through modelling, questioning and discussion is reduced and there is likely to be fear of avoidable accidents. This, however, may not be true as the alternative learning options could allow for more equitable access to all students. If the demonstration was completed using an interactive video tool like Vizia, the questions would be used to prompt comprehension. Through video, classroom distractions can be removed and there are no impediments to seeing and hearing. There is also the capacity to pause, rewind and watch multiple times.

In order to implement new digital tools in the classroom, the processes need to be clear and consistent for teachers. The teachers in my study all indicated that they found the use of digital tools in the classroom problematic. There is a need for technical support and time for teachers, not just to access and prepare resources but also to display and use resources effectively with classes. Ideally, quality and relevant digital resources would be developed at a national level that could easily complement or replace aspects of teachers' current programmes. Due to cost and logistics it is unlikely that a lot of time will be dedicated to teacher professional development to develop the skills needed to use new tools; therefore, the resources must be developed in a way that they are easy to access and operate from a teacher and student perspective. Teachers have indicated they would use a new technological intervention if it were relevant, had clear educational benefits, supported the teacher's higher moral purpose and had simple, clear and concise instructions.

In the next section, I dig deeper into what it means to be a foods teacher through a case study completed at Middleton Grange School.

3.2 Case Study

In this section, I summarise the key findings from a case study at Middleton Grange School (MGS) over a period of three weeks from 23rd October to 9th November, 2018. I have gathered data from a range of sources including observation of foods classes, observation of Year 7 and 8 homeroom classes, informal discussions with teachers and leadership, school information scanning, classroom planning, a student focus group and a teacher focus group. In my discussion, I focus on research sub-question 2: 'What interventions will be suitable for this school?', taking into consideration the learning environment that is MGS and the digital capabilities and limitations of the school found within the case study.

3.2.1 Methods

3.2.1.1 What is Case Study

Johnson & Christensen (2012) describe case study as "a form of qualitative research that is focused on providing a detailed account of one or more cases" (p.395). Case, Creswell (2012) explains, comes from the medical term case and refers to a bounded group that may be "a person, group of people or a unit" (Gustafsson, 2017, p.2). Gillham (2010) claims a case study looks for the best possible answer to a research question through a range of evidence, found within the case. Taking a case study approach allows a richness of data that can allow deep insight into areas that may not be seen in other methods (King's Psychology Network, 2018).

Yazan (2015), however, cautions against case study being used to generalise the population as its focus is on evaluating what is happening within the particular case. Lichtman (2011) adds that we should not apologise for the fact the study is restricted to one case, and is not a summary of the whole, claiming it is not the purpose of a case study to provide a summary of the whole population; case study gives a deep insight into one localised situation. Likewise Thomas & Myers (2017) explain that the data stands on its own, and the ability to use this data beyond the case happens when correlated against other such data, over time. Gerring (2004) further reinforces this message, defining "case study as an intensive study of a single unit for the purpose of understanding a larger class of (similar) units" (p.342).

3.2.1.2 Why Case Study

With the diverse nature of schools, teachers and students, taking a qualitative case study approach to this part of the research allows me to understand in more detail what solutions

could work for this particular group of students. Case study, with a more fluid, less defined methodology, allows researchers to look with open eyes at a case, exploring and digging to find out what is happening. This ability to look from different angles allows us to see "a more rounded, richer, more balanced picture of our subject" (G. Thomas & Myers, 2017, p. 4). Yin (2009) claims that "the need for case studies arises out of the desire to understand complex social phenomena" (p.4). Because no school is the same and no student or educator is the same, the make-up of a school is a complex social phenomena. Case study thus allows us to tailor the study to suit the needs of the specific school and adapt to their inherent complexities, with the details of the study being flexible and able to evolve depending on what is learned within itself.

3.2.1.3 The Case Study Method – if there is a Method?

Some researchers argue that there is no set method for case study. According to Thomas & Myers (2018), "it is a design frame that may incorporate a number of methods and analytical frames" (p.2). I have, however, used Gillham (2010) to form the basis of my case study methods. One of the fundamentals of Gillham's approach is that it is important to avoid predetermined views on what we will find, and instead come with a question and use the information you find to answer it. Johnson & Christensen (2012) reinforce this message, recommending we look holistically at the case to try and uncover what is really happening. Case study has within it a number of key elements including interview, analysis of written data and observation, and the combination of these data sources is often referred to as triangulation. Lichtman (2011) claims triangulation is no longer widely used, but the ability to support data with multiple sources is an important way of justifying the evidence and ensuring accuracy. Lichtman (2011) also highlights the importance of focusing the study to ensure it is achievable. I have narrowed down my research question and kept my study to the specific Year 7-10 foods programme at one school.

Gillham (2010) highlights two potential causes of inaccurate data from a case study. Firstly, the fact that the researcher is a visitor to the situation means that there is an inherent impact on the normal environment, simply through their presence. To attempt to counteract this disruption where possible, I took on the role of 'participant observer' as described by Lichtman (2011). This involved me working alongside those in the class, at times taking on an assistant teacher role, allowing me to blend in as much as possible. Gillham (2010) also raised the bias the researcher brings with them, in the form of pre-determined expectations or preferences as another issue for researchers to be aware of. He recommends answering two questions prior to the case study "What do I *expect* to find?" (my prejudice), and "What

do I hope to uncover here?" (my preference) (Gillham, 2010, p27). Through answering these questions, I can look beyond what I expect to find and hopefully see a clear picture of what is happening. Sofaer (1999) claims it is important that when a pattern is found in the data, or in other words, the researcher uncovers a hypothesis, they should "search systematically for evidence that will lead to the rejection of the hypothesis" (p.1104).

Observation is one of the key tools used within case study and it has the potential to uncover key insight into what is happening within the case. Gillham explains:

> *The overpowering validity of observation is that it is the most direct way of obtaining data. It is not what people have written on the topic (what they intend to do). It is not what they say they do. It is what they actually do (which may also be reflected to some extent in records) (Gillham, 2010, p. 46).*

Gillham, however, also cautions that whilst observation appears easy, the accuracy of recording observation data makes it both "highly fallible and highly selective" (p.47). The discrepancies in what is recorded compared to what is observed is a genuine concern, and a key tool to avoiding this is ensuring observation data is written up as close to the event as possible. Gillham proposes the use of a Research Journal that diaries the research journey, including notes on conversations, observations, questions and hunches. He claims "the log book is more than a set of rough notes: it is a fundamental part of your database, and needs to be treated with respect" (Gillham, 2010, p.23). Consequently, it is a rough draft of your journey as a researcher and this should be something that can be read and interpreted by other researchers. Cohen, Manion, Morrison & Keith (2018) describe a plethora of ways data can be gathered in case study research but what ties it all together is the researcher's "ongoing analysis, reports, comments and narrative on the data" (p.387). When possible, I recorded key points or quotes as they occurred and then typed the journal up at the end of each day, including what I observed, what I heard, and what I was thinking.

3.2.1.4 Focus Groups

Focus groups are groups of people chosen from the target audience that are interviewed together with a "reliance placed on the interaction within the group" (Cohen et al., 2018, p.532). The goal of the focus group is to get a collective view of a topic rather than just an individual one. According to Johnson & Christensen (2012) focus groups "are very useful for providing in-depth information in a relatively short period of time" (p.205). The synergy created within the group helps participants to extend their thinking and expand on other's thoughts. (Powell & Single, 1996). Peterson & Barron (2007) explain "A well-run focus group will generate a rich exchange of ideas that are bounced around so that all participants have

the opportunity to respond and comment" (p.2). This being said, the success of the focus group is dependent on being well-planned and requires a moderator with the appropriate skills to focus the group towards the areas of research (B. Johnson & Christensen, 2012).

How we start the focus group is important as it sets the tone and is an opportunity to help participants relax. I provided food and drink for the focus groups and allowed time for participants to talk prior to starting. Barbour (2011) suggests providing a chance for each participant to contribute through the use of a non-threatening question or starter. Powell & Single (1996) also highlight the importance of the start of the focus group saying "this 'ice-breaking' interaction cannot be underestimated, as it relaxes participants and fosters an atmosphere conducive to frank discussion" (p.502). Krueger (2006) recommends easing participants into a topic, saying it will not only make them more likely to share openly but also allow more time to recall memories. It is however, important to be aware that being part of a group could mean, as Powell and Single (1996) so simply explain, participants adjust their responses to "jump on the group bandwagon", so to speak (p.502).

Unlike the interview protocol, however, the focus group questions, part of the topic guide, are more fluid and don't have a fixed structure. Krueger (2006) suggests the order of the questions moves from the less threatening, increasingly towards the topic of importance to the researcher. The moderator's role is to keep the participants focused on the topic at hand, but how this is achieved will vary from group to group. According to Powell & Single (1996), the topic guide should include five or six questions, that are carefully written, easy to understand and open-ended. Barbour (2011) supports the limited number of questions in the topic guide, claiming "a few brief questions and well-chosen stimulus material will be sufficient to provoke and sustain discussion" (p.10). Despite the brevity, however, the planning should be well thought out, anticipating responses and trialling topic ideas prior to the focus group. An alternative to the traditional question based, focus group is to use anecdote circles, a method that encourages participants to tell short learning stories (anecdotes) that allow the "researchers to explore themes related to a situation while providing representational stories about an organization through the lived experiences of the participants" (Ramlo, 2017). Coney et al.(n.d.) used anecdote circles to encourage teachers to share stories about their personal learning experiences, and then extended the activity further by prompting them to categorise and look for themes within the stories. I used the anecdote story method with the student focus group but I did it later in the focus group, allowing time to develop rapport and relax the participants prior to asking them to reveal

personal stories. This followed the suggestion of Krueger (2006) - gradually increasing the level of threat.

The use of stimulus materials to elicit responses is highlighted in the literature, including the use of video, vignettes, role-playing, cartoons and newspaper articles. Care, however, needs to be taken to ensure the stimulus material does not lead the participants. Barbour (2011) promotes the use of cartoons as an effective stimulus, claiming they can present relevant information in a humorous way, often 'breaking-the-ice' into a difficult topic. Barbour also supports the use of stimulus to add humour to the discussion, keeping the participants engaged and relaxed.

Getting participants to write their ideas down is promoted as a way of gathering deeper insights from focus groups, including through written surveys and sticky notes. Barbour (2011) highlights the benefits of using individual written forms as part of the focus group, explaining the depth of data that can be gained through the private voice, what they say away from the group, often varies to what is spoken in the focus group. Another method for getting more students involved in the discussion is the use of sticky notes. Sticky notes can be used in a range of ways that allow multiple participants to contribute to the discussion simultaneously. I used a sticky-note activity, adopted from the work of Peterson & Barron (2007) shown below.

1. *Participants individually write down ideas and post them on the paper.*
2. *The moderator clarifies understandings, opening room for elaboration and discussion.*
3. *Groups organise the sticky notes into groups, with duplicates to be made if agreement is not achieved.*
4. *Discussion about the different groups.*

Peterson & Barron (2007) claim that getting participants to write their own ideas down increases the feeling of involvement in the discussion, and it is also more likely that shy participants will contribute.

I ran two focus groups, one with teachers and one with students. The goal was to elicit data for research sub-question 2: 'What interventions would be appropriate for this particular school?' With both groups, I used a range of stimulus material including images, cartoons and a short video that shows a young child using an iPad (UserExperiencesWorks, 2011). The focus was on finding what participants felt had the most effect on learning and the questions and sticky note activity allowed them to unpack this. I probed to establish what digital tools they currently used and sought feedback on how they felt food-based education

could be improved with the use of digital tools. The topic guides shown in Figure 4 and Figure 5 show the questions used.

Student Focus Group – Topic Guide

1. (Figure 1) What is your favourite subject at school? Why?
2. (Figure 2) (Sticky Notes) Think about your time at school, what were some of the things that have helped you to learn and also some things that prevent you from learning? Write each idea onto a separate sticky note. When you run out of ideas, add your notes to the poster under the appropriate heading. Things that help me learn, things that don't.
3. (Figure 3) use to prompt after brainstorming runs down
4. (It's not an Ipad video) How are your teachers using technology in your classrooms?
5. If you think about your foods lessons, how could technology be used to make them better?
6. I remember when I was at school there was one time when our teacher came back from overseas and gave us a design challenge. It was summer and the flies were starting to be pretty annoying. The teacher set us a group task to design a new way of getting rid of flies.....I remember we worked on it for hours, trying to find a new way to solve the problem of flies. It was so engaging that I still think of it as one of my school highlights today..... Can you think of a time when you really loved being at school? What made it special?

Figure 4 - Student focus group - topic guide

Teacher Focus Group – Topic Guide

1. (Figure 1) Can you explain to me why you choose to work at Middleton Grange School?
2. (Figure 2) (Sticky Notes) If you think about the students at MGS, what do you believe are the things that help them learn and potential limitations on their learning? Put all the ideas down onto separate sticky notes and when you run out of ideas add them to the board.
3. Now, can you please organise the sticky notes into groups. Feel free to duplicate any that belong in two areas. Label...
4. (It's not an Ipad video) Can you give examples of how you use technology in your classrooms? What tools / programs have you used with the learners?
5. If you think about foods lessons, both the practical and theory lessons, how could technology be used to enhance them?

Figure 5 - Teacher Focus Group - Topic Guide

3.2.1.5 Making Sense of the Data

In the findings, I show data from two distinct areas of the case study. First, my journal of the experience, documenting what I saw, felt, heard and assumed. Secondly, the data gained through the focus groups was transcribed and examined for recurring themes. In order to

make sense of the data, I adopted a method suggested by Yin (2002), examining, categorizing, tabulating and testing (as cited in Yazan, 2015).

3.2.1.6 Māori Consultation

Māori consultation was sought [Appendix C] and approved on behalf of the Ngāi Tahu Consultation and Engagement Group (NTCEG) by Henrietta Carroll on 8th October 2018. [Appendix D]

The reason for consultation was because the research would involve observations in classrooms and involve potential interactions with students and teachers who are Māori. My goal was to make all participants feel comfortable, giving me a greater chance of hearing their unique perspectives. The overall student roll at Middleton Grange School includes approximately 7% students identified as Māori. It was my intention to try and have at least one student from this cohort as part of my student focus group to gain a wider perspective of cultural views, but unfortunately, this was not the case.

3.2.1.7 Ethics Approval

Prior to starting the case study my Low Risk Ethics application [Appendix E] was approved by the Director of the Human Interface Technology Lab NZ and this was subsequently accepted by the University of Canterbury Educational Research Human Ethics Committee. (2018/07/ERHEC-LR). [Appendix F]

3.2.1.8 School Selection

After looking at the schools near the University, Middleton Grange School (MGS) was identified as a suitable school for my study. MGS is an integrated Christian school for pupils in Years 1-13, something that is quite unique in Christchurch where the majority of secondary schools only cover Years 9-13. With my study looking at students in the middle school, MGS provided an opportunity to explore both the Year 7-8 area, typically delivered in a primary or intermediate school, and the Year 9-10 area, typically the first two years of secondary school

3.2.2 Findings

3.2.2.1 About Middleton Grange

Middleton Grange School (MGS) is a state integrated Christian school.

State integrated schools "differ from other state schools in that:

1. *a private entity, the 'proprietor', owns the school buildings and land and is responsible for ensuring the buildings meet Ministry standards*
2. *integrated schools usually charge compulsory 'attendance dues'."*

("Integrating schools | Education in New Zealand," 2018)

"As a state integrated school Middleton Grange teaches the New Zealand Curriculum. The point of difference with a non-integrated state school is that Middleton Grange teaches the New Zealand Curriculum within a Christian context and from a Biblical worldview" (Middleton Grange School Charter, 2018, p.5). All teachers are committed to the Christian ethos of the school. This is outlined in the MGS Charter where it states there is a "clear commitment by all members of staff and board to the Statement of Belief which includes the profession of personal faith in Jesus Christ as Saviour, Lord and God" (2018).

MGS provides a seamless education from Year 1-13 through its three separate areas Primary, Middle and Senior school. The primary school, catering to students in Years 1-6, teaches in traditional, age based home classes where the majority of the programme is led by their home teacher. The middle school, catering to students in years 7 to 10, delivers the majority of the curriculum through the homeroom teachers at Year 7 and 8 but this is incrementally reduced, so that by Year 10, only one core subject and scripture is completed with the homeroom teacher.

3.2.2.2 Time

It was not long until *a lack of time* the key finding from the interviews became apparent.

> *As the bell sounded I watched the teacher pack their work away, issuing final instructions to the students as they worked. I followed as the teacher briskly walked down the hall, outside, down the stairs, around the corner and back into the foyer of the foods room where she was met by an excited bunch of 20 students. The teacher greeted them and directed them inside, following quickly to check the correct ingredients were ready and ensure the whiteboard was up to date. The students washed their hands and started to get noisy again when the teacher brought them around the front of the room, quickly cautioning a couple of students as she starts to explain the lesson. Already over 5 minutes into a 50 minute lesson I can't help feeling sorry for the foods teacher, so many things to battle in what was now only a 45 minute lesson. In the back of my mind I thought of the other practical subjects like hard materials or physical education and wondered how effective their classes could be with so much time lost to setup and pack down time.* (Research Journal, 24th October 2018)

This anecdote highlights the compounded pressure of sharing a classroom, teaching multiple curriculum areas and moving across the school in short lesson times. On top of this it lends evidence to the theme, shown in the interviews section, around time constraints on practical cooking classes.

3.2.2.3 Foods Programmes

The food programme at MGS is compulsory at Year 7 and 8, with students completing one trimester (13 week) rotation of food technology in the two years. The rotation includes one theory and one practical lesson a week. On the sixth rotation, at Year 8, the students are given a choice and some students will do a second rotation of foods classes at this stage. The focus of the programme is on food technology with food and nutrition woven neatly inside of this. Food technology can also be selected as an option for students at Year 9 and 10, but at Year 11 the focus of the programme shifts and students complete their school qualification credits, NCEA, in food and nutrition.

The practical cooking lessons I observed all followed a similar pattern; the students arrived and completed the necessary Codes of Practice (CoPs) steps, wiped tables, washed and dried hands, tied up hair and then met the teacher at the front of the room with the recipe. The teacher talked through the steps, briefly highlighting any complex parts of the practical cooking and asking questions to clarify understanding. When available, a photo of a possible end product was shown on the TV in the room. A student led the start of class prayer and then the students went to cook.

Surprisingly, after the results of the Interview section, I only observed two demonstrations in the 10 practical foods lessons I was a part of, and these were brief lessons taught when one group reached a critical point so the teacher would bring everyone over to share. One example was producing an omelette. The teacher called everyone over to show when the omelette was suitably browned and demonstrate how to put it in the oven to grill. This lack of specific demonstration time led to a range of techniques and incidental learning that happened in the room. In an interesting example, I observed a range of ways students juiced a lemon; one group cut it in half and squeezed, another cut it into quarters and squeezed, while others cut it in half and used the hand juicer. One pair of boys finished juicing their lemon the same way as the girls working next to them and then noticed that the girls had approximately twice as much juice as them. When they asked why, the girls taught them to roll the lemon before cutting.

While the timetable separating the theory and practical lessons onto different days did ensure the theory aspects of the programme were taught, there were also negative consequences. Practical cooking lessons were sometimes out of time before the products were completed, and there were lost teachable moments.. The teacher sometimes had to ignore on the spot learning opportunities in order to fit the cooking into the short time frame. One observation was when the students were making a tuna salad with egg, lettuce, potato, olives, tuna and a lemon dressing. One group put the potato on to boil whole, meaning it was going to take about 45 minutes to cook through. It was noticed by the teacher after about 10 minutes and they were advised to cut it up. I watched as the students cut open their potato revealing the obvious ring of cooked potato, but the opportunity to share this with the class was missed due to the lack of time left in the lesson.

One of the highlights for me was the authentic quality of the middle school foods programme, resulting from the real-life clients the students were asked to cook for. The Year 8 option course included a tax system where the students had to donate a portion of their cooking to a local charity. The teacher taught children about some of the local charities like the City Mission, the Salvation Army and Ronald McDonald House and the students made the choice on where each selection of food would be taken. After the donations were delivered, the teacher made a point of reporting back to the class, usually by reading a thank you letter from the charity. The Year 9 course worked towards the students preparing a morning tea for the junior school students, and the Year 10 students were catering for parents at the Year 10 prize-giving celebration.

Two other elements stood out to me; the depth of learning developed in the students' projects and the compulsory home-cook. Participant 1 in the teacher focus group describes this saying "In technology I can do a multi-disciplinary type approach, I can tie Art, Health, Science, Design and Business into the programme". This is shown in the Year 10 examples shown in Figure 6 where the students have created a new healthy food market that could be implemented in the city post-earthquake. They are given a range of materials in class to support the design but students are not limited in how they present their projects as long as they have a three dimensional element to them.

Figure 6 - Fruit and vegetable shop design & mobile fruit and vegetable shop design (on wheels)

The other activity that stood out was the Year 7 home-cook assignment that involved the students preparing and cooking a celebration meal at home. The students plan the meal including producing invitations, developing menus, completing table settings, preparing food, serving and arranging feedback. The students then choose how to present a report back to the teacher; for most students this was a poster. The quality varied but I witnessed the value when one quiet girl came excitedly into class with her poster.

> *As the class walked in a girl rushed up to the teacher with her poster showing her home cook assignment. The teacher stopped what she was doing, opened up the poster and, mirroring the students enthusiasm, she commented, "Oh look at that place setting. You have created a word find. What a cool idea. Wow." In the twenty second exchange, I watched as the student's face lit up more and more.*
> (Research Journal, 5th November 2018)

This highlights another aspect of the foods programme; not only do the students have authentic tasks but the teacher also values their work. On top of the observed exchanges between teacher and student, I observed a large amount of student work on display in the hallways, in the classroom and in the school library. The teacher also sourced experts to teach specific skills including a pastry chef who worked with the students on decorating skills for use on their picnic dishes.

One of the issues observed was to do with the classroom layout. With the sinks and ovens being used at the same time, at one stage there were five students working in the space around the oven shown in Figure 7. This is a common problem for school kitchen designers. With the number of students typically four per oven, there are health and safety concerns with congestion. This being said, the kitchen was warm and inviting and had a degree of flexibility with the portable preparation tables in the middle of the room. This kitchen does, however, pose a similar issue to that discussed in the interviews section, having no dry area for digital devices.

Figure 7 - Kitchen design flaw

The capacity for digital learning in the foods area is restricted to the use of one computer with an attached television that, on the first two days, was of no use due to having no internet access. The teacher used the television to display pictures of recipes and the students sometimes used the computer to search out different recipes. There is also very limited space or time for digital innovations during the practical foods lessons. The teacher mentioned using the computer labs (when they are available) but the majority of the theory lessons are completed in the theory room that is much smaller than a traditional classroom, making group activities difficult.

3.2.2.4 The Primary School

In order to gain an understanding of the exposure to digital learning prior to attending the Middle School, I visited the Primary Section of MGS. When I introduced the purpose of my study, the first thing raised by the Head of Primary was the un-reliability of the digital devices, and of particular concern was the reliability of the network. Each classroom has access to a group of about eight devices, iPads in the junior school and small laptops in the senior primary school. The older students also have access to a shared learning space that has about

eight fixed computers that the Head of School described as the ones the students rush to get to, because they are quicker and reliable with a fixed network connection. Each classroom has a teacher computer linked to a large TV or a data projector, and these are used for presentation and class research by the teachers.

The Head of School shared concerns about children, particularly young children, spending too much time on screens. The intention of the school was that computers would be used to enhance learning but at this stage there is no intention to move to 1:1 devices in the primary school.

3.2.2.5 The Middle School Classroom

During my time, I visited two lessons in the Middle School homeroom classes, one at Year 7 and one at Year 8. In the first classroom, I observed a reading session. The teacher worked with one group while the other students worked through a list of reading related tasks they had been emailed. The email included links to an online video and a range of potential options for presentation of the data including the opportunity to create a digital movie. Some creative thinking was involved in the lesson and it showed that with suitable devices and network this teacher was ready to use digital technology to enhance student learning. Shortly into the lesson, one student arrived with the laptop trolley and handed out the laptops. This all happened while the teacher was working with one of the reading groups; however, ten minutes into the lesson many of the laptops had not yet loaded the students' desktops and some laptops had been swapped because the battery had failed.

In the second class, I observed a gamified Social Studies lesson. Taking the format of a treasure hunt, the students worked in pairs to locate answers in the given textbook, write the answers into their workbooks and then run to the teacher to get them marked and points awarded to the chart for successful answers. The students still read the questions and found the appropriate answers; however, they were involved in a competition and the scavenger hunt process appeared to keep them engaged, moving and talking about the work at hand. This example raised two key areas where technology could be used to enhance the activity; firstly, technology could be used to assist when students don't have the literacy level to compete and secondly, to get the teacher away from the marking and recording of marks.

The lack of access to quality devices was highlighted as a frustration by both of the middle school teachers. Both of the teachers were completing a Postgraduate Certificate in Digital and Collaborative Learning through The Mind Lab (2019) and were constantly looking for ways to implement new digital learning activities into the classroom. Both teachers also teach

digital technology as part of the Year 7 and 8 technology rotation. In this rotation part of the technology programme, the students have completed some coding, robotics and 3D design. The current project, the creation of a flipped learning video to teach a new skill to students in a Year 4 class, involved them defining the skill, developing the script, writing a questionnaire and developing the learning video. Most of the digital technology use I saw at MGS was research or presentation of work and this would be positioned in the early stages of the SAMR model. However, the development of a flipped learning video is an example that shows how technology can be used to transform learning.

3.2.2.6 Teacher Focus Group

For the teachers focus group, four teachers were invited but, unfortunately, at the last minute two of them were unable to attend. The focus group, therefore, consisted of two teachers, one a middle school teacher (Participant 1) and one a specialist foods teacher (Participant 2). We met during the lunch hour in the foods room.

When asked what technology they used in the classroom, the issue of the network and lack of devices was raised again but despite that Participant 1 said they have used Kahoot ("Kahoot!," n.d.) flipped learning, made YouTube videos ("YouTube," n.d.) for the students and let the students make iMovies ("iMovie - Apple (NZ)," 2019). As part of the regular homeroom programme, three online digital learning tools were used, Education Perfect ("Education Perfect," 2019), NZ Maths ("e-ako maths adventures | nzmaths," n.d.) and Write That Essay ("Write That Essay," 2018). These tools look very engaging and appear to contain a range of gaming elements like badges and points. Participant 1 said that they would like to use technology more often but the lack of devices was so frustrating that they were using their personal iPad to allow the students to make movies. Participant 2 was mostly using the computer to display images or videos claiming "we only have the one computer and four wee laptops but because they never connect we just don't use them. I always encourage them; the projects are always research based and they need to publish them".

Interestingly, when talking about how technology could be used to enhance the foods programme, it was suggested that the foods lessons could be videoed and made available as a flipped learning option. This closely reflects the need identified in the interviews of the teachers' desire to have video lessons that support their demonstrations.

The teachers were asked to use sticky notes to answer the question:

If you think about the students at MGS, what do you believe are the things that help them to learn and what are the potential limitations on their learning?

The responses were sorted by the teachers and are shown below. Table 4 shows the enablers, and these have been categorised into five headings: the programmes, the teacher, teacher student relationships, student attributes and the technology. When asked what section made the most difference to the student learning, the teachers unanimously agreed relationships was the key.

PROGRAMME	TEACHER	RELATIONSHIPS	STUDENTS
• Practical application • Hands on • Inquiry • Exemplars • Modern new recipes • Fun outcomes to show learning ie, 3D models, brochures, diagrams • Activities at the right level • Elements of choice • Cell phone access to search engines • Solving a problem, eg. obesity, bad smelling, healthy snack design and production • Differentiated tasks • International (variety of programme to suit culture) • Feasibility - real life assessment of factors affecting final design	• Teacher enthusiasm • Vocab explained and can be accessed again and again • Vocab - Language - know words of tech • Having instructions in a variety of ways (verbal, visual, written) • Standardised prep for assessment Y7-10, gaining confidence, scaffolded • Time to talk with the teacher • Talk, share, brainstorm together • 'I don't know' teachable moments • Punctual return of work with indicative + resit option	• Teacher interest 'don't care how much I know until know how much I care' • Feeling supported • Feeling safe • Good relationship with teacher • Email parents expectations • Home school relationships	• Being able to listen to instructions more than once **TECHNOLOGY** • Having access to answers at the click of a button • Cellphones – search engines

Table 4 - Enablers of learning - teacher focus group - sticky note activity

The majority of the comments under the heading enablers for learning fits under the three categories, programme, teacher and relationships. The key thinking from the programmes section was providing differentiated tasks and real-life problem solving activities that require hands-on learning. The teachers' section involves teachers providing the necessary scaffolding for students to achieve in an authentic inquiry based programme. The relationship section, as highlighted by the participants, is the key to making the programmes work. I think the quote "they don't care how much you know until they know how much you care" (Participant 2) summarises their thinking well.

The things that prevent learning are categorised under the headings: students, teacher / professional learning and development (PLD), resourcing and time. The student issues include the students coming in with stress from home and potentially being overloaded with after school activities. The ability of the teacher to keep up with what they need to do in order to teach was closely matched with the lack of time teachers have to prepare. The resourcing section referred mainly to the lack of reliable internet and a lack of devices for use in the classroom.

STUDENTS	TEACHER / PLD	RESOURCING	TIME
• Worries, home, homework, health, friends etc • Too much on after school to have time for homework • Stress from home	• Constant need to keep up • Teacher knowledge is limited • PD - what does society want for their future children?	• Access to technology • No access to devices at home to do homework • Internet access • Lack of resources • Resources that don't work • Synced notebooks	• Time to create new things (teacher) • Limited time • Practical only

Table 5 - Limitations on learning - teacher focus group - sticky note activity

The participants were both very passionate about their jobs and complemented each other well; one was very digital savvy, and the other was experienced and had strong pedagogical knowledge and pastoral experience. Both participants highlighted the spiritual calling to work at MGS, the comradeship with staff and the relationships built with students as the key things that keep them at MGS.

3.2.2.7 Student Focus Group

Seven students were invited to the student focus group, and five of these attended during a lunch break at school. The participants were all from the Middle School and of the five participants, two were male (Participant 2 and 5), and three were female. Two of the participants had attended MGS for the whole of Primary School while one started in Year 4 and two started in Year 7. All of the students had completed at least one rotation in the foods room. The Year 7-10 foods teacher, who was not involved in the discussion, was working quietly in the background during the focus group.

Three out of five participants stated that they liked their favourite subject because it allowed them to be creative. This was reinforced later when the students were asked to tell a brief anecdote about a time when they really loved being at school and what the teacher did to help them learn. Three of the students told stories about making new things, a bird house, a

musical instrument and a plane. The birdhouse was of particular interest to me as it appears that a large part of the enjoyment stemmed from the project being given the gamification element of competition as well as an authentic prize. Even though Participant 4 didn't win, this was a key learning experience:

> *It was like Year 2 or 3 and we got all these pieces of cardboard and stuff and all got to make our own birdhouse. And out of each house there was like one they picked and they actually got to build it out of wood and put it in the trees around the school. It was a special time to show what you could do. If you don't like others seeing your talents you could actually just show them because you were in groups*

Working in groups is a theme discussed by four of the participants and was generally highlighted as having a positive effect on their learning. One participant, however, felt they were a lot more efficient working independently and highlighted twice the fact that both the teacher and their peers could have a major influence on their ability to focus and learn.

The students' comments mirrored that of the teachers in regards to relationships. It is important to the students that they feel safe, highlighted by Participant 5 saying "that was probably the best year I had at school. I had a great teacher; yeah the previous year I got bullied a lot so I really enjoyed it because I had a great class that wouldn't tease me." In this statement, the participant is also highlighting one of the key features of MGS that occurred in a number of other classes; the students feel safe and are able to express their personal insecurities without fear of rejection. My interpretation of this participant's statement is that the 'great teacher' creates the safe environment. The ability to make things fun and make students feel special was also obvious. Participant 1's most memorable learning experience was the time they felt special because a teacher chose them to join an art and craft group, highlighting her strengths. Participant 2 shows the power a teacher can have, also reinforcing the need to feel safe, claiming "she really did care about what she was teaching; she didn't just give us something to do. She helps us be great and she wanted us to be great, and she was a teacher who when we make mistakes she wouldn't criticise us; she would help us to resolve them"

Like the teachers, the students were also asked to describe the things that help them learn in a sticky note activity. Table 6 shows the student responses under four headings: teacher, peers, resources and other. The importance of the teacher is highlighted again here and when the students were asked the most important aspect of their education, they all pointed to the teacher section. They describe their ideal teacher as one who knows them and responds in ways that suit them. Some participants wanted a teacher who was able to explain while others

wanted teachers that motivated them with interesting activities. Interestingly, two participants attributed peers as being great motivators. Participant 4 claimed "they encourage me to do things I think I can't, but then I can". Interestingly, the students did not mention the lack of digital resources as a limitation on their learning.

TEACHERS	PEERS	RESOURCES	OTHER
P5 My teachers are helpful because they have a lot of knowledge to share P4 My teacher because I am a slow learner but she waits P1 A direct approach. My teacher would ask me what the problem was and that way she could help me improve P3 When the teacher gives an example to show how it works P2 Good teachers that can motivate me to do my best and teach me positively.	P4 My class can help and not help because they talk a lot so loudly but then sometimes they can be great P2 My peers because if I'm surrounded by people that can encourage me to do great I can do better P5 My class because they are willing to help me or explain the activity clearly P4 My friends because they encourage me to do things I think I can't, but then I can	P3 Having the right resources to help me do a task. Resources like books, computers and other technology. P5 Resources such as our good library, languages, technology, options and having access to a computer	P5 My parents because they are willing to help and teach me what others can't P1 Leaving me to my own devices. I like learning stuff on my own and I like being independent P5 The bible has helped because I can pray to the Lord when I need help/healing/worries P5 The Scriptures because they can give me good wisdom

Table 6 - Student focus group - sticky note activity – enablers

Table 7 shows the limitations, as described by the students. Perhaps, because this was a younger group of students, many of the comments in the limitations section are the reverse of the enabler comments shown in Table 6.

TEACHERS	PEERS	SELF
P2 The teachers who don't motivate or doesn't care about teaching the subject P1 Teachers pestering everyone every few minutes if we were trying to focus; they'd just clap, get everyone's attention and we wouldn't get any work done P3 When something is only briefly explained and I'm expected to know what to do P5 When the teacher just gives us a text book and can't explain	P4 Friends because they always want to talk and if I want to learn, they say "why?" and it gets annoying P3 When I don't have anyone else to share my ideas with and grow it P1 Distractions – I like being independent and, being introverted, so when everyone is loud and harsh, then I can't focus at all P4 My class can help and not help because they talk a lot so loudly but then sometimes they can be great	P5 Since I have only been here a year my knowledge of things like language

Table 7 - Student focus group - sticky note activity – limitations

3.2.3 Discussion

3.2.3.1 Time

A lack of time is a theme that continued through this section and is a key concern for the effective delivery of foods education. Whenever the classes were followed by a break, the students inevitably worked well into the break in order to finish the cooking, and on a number of other occasions food was left on trays or still cooking as there just wasn't time to complete in the lesson time. This mirrors the findings of the Interview section but is compounded by the fact that the teachers are sharing one foods room and the transition from one room to another also reduces the time in the classroom.

3.2.3.2 Space

On top of the lack of time is the limited kitchen space that means only a finite number of practical foods lessons can be completed in the foods room. The other lessons are delivered in the very small theory room that is setup in a typical lecture style to enable the furniture to fit in the room. This is not conducive to quality student-centred learning opportunities. The

separation of the theory lessons by timetable means that the ability for students to effectively evaluate learning is difficult due to the time between the lessons, and the fact the food product has been previously eaten after the practical class. Despite the limited space, adding a teacher cook space to the theory room would enable some of the demonstrations and evaluation sessions to be completed out of the practical lesson time. Another potential solution could be changing the timetable to allow for practical subjects to have back-to-back lessons, allowing theory and practical lessons to link more smoothly. Likewise, the corridor space could possibly be utilised to create a larger, collaborative cooking space where two classes can work concurrently. This expanded area could incorporate a digital space where students have easy access to digital learning tools that support their learning.

3.2.3.3 Digital Capability

It is clear that the existing digital landscape of MGS does not support a rapid implementation of digital innovation. The network issues were raised by all participants in my study and the lack of reliable computers or devices was apparent. This being said, there is a planned rollout of 1:1 devices for learners in Years 9-13 in 2019. It is my understanding that this will involve significant advances in the network capability and it will open up opportunity for a lot more aspects of learning, especially in regards to the use of games and gamification to support learning. Not involving the Year 7 and 8 students in this upgrade was expressed as a concern by teachers and one that will limit the capacity of foods teachers at this area; however, all of the five focus group participants indicated they have access to personal devices at school that could be adopted for use in the programme.

There was a mixed degree of readiness for the 1:1 rollout among the teachers, but there was a general willingness to take on the challenge if it would help the students. The social studies class that used the treasure hunt gamification to explore a text book showed the capacity of teachers to create interesting activities that are meaningful for students, and the ability to enhance this with the use of online tools is exciting. The students I observed showed they can adapt easily to the use of technology. The digital class where students showed confidence in the use of 3D modelling, green screen videos, screen casting and scratch showed that given the opportunity these students could successfully complete any innovation I returned with in the final stage of this study.

3.2.3.4 Special Character

During my time, I witnessed students talking openly in front of the class about sometimes, very personal issues; this included during the student focus group where students were able

to express their own insecurities without fear. This safe, welcoming environment is one, I believe, that is nurtured by the special character of the school but also by the love and compassion of the teachers. It resonated with me in the quote from the teacher focus group where a teacher posted that the students, "don't care how much I know, till they know how much I care." A quote similar in nature to that by McKenzie and Singleton (2009), "The culture of the child cannot enter the classroom unless it has first entered the consciousness of the teacher" (as cited in Peters, 2010).

3.3 Summary

Through both stages of this qualitative study, the key issue has been a lack of time, and this is an area that can potentially be improved through some strategic use of technology. The issue of time is two-fold. Firstly, the time in class with the students is limited to between 50 and 90 minutes. The limited time causes issues for teachers who, in most cases, have to complete the whole cooking process in the given timeframe and do not have an option to continue the lesson at another time due to storage of foods and hygiene risks. The other area of time is the limited time teachers have with the students, as low as 13 hours of compulsory practical foods lessons over two years at Years 7 and 8. The desire of teachers to empower students to eat healthy food and provide the necessary skill and experience to make this possible, is limited in such confined time constraints.

The capacity to teach the key aspects of health and safety, termed the Codes of Practice (CoPs) by the MGS teacher, is a common concern for teachers. This could be the best focus for an innovation, one that allows for effective teaching, learning and assessment of this critical aspect. A carefully planned intervention could potentially enhance the learning in this area, but also, through the use of a flipped learning, gamified approach, this important part of the programme could effectively be removed from the kitchen, creating more time for practical cooking experiences.

It is unlikely that there will be a substitute for practical, hands on cooking but the use of technology can certainly be used to enhance or support the key learning outside of the kitchen. Some of the scenarios discussed include online games that allow students to locate and fix health and safety issues, virtual kitchens that allow students to try out a recipe prior to working in the kitchen, flipped learning that includes the teacher making the demonstrations available as videos for students to watch when required, augmented reality that shows learners where foods come from and 360 degree videos that effectively bring a chef into the classroom. One participant mentioned how hard it is to get students to

complete tasks outside the timetabled lesson. For this reason, whatever the intervention, it must be carefully planned in terms of effective learning content but also highly engaging so students want to use it.

In the next chapter I outline a number of potential solutions considered for this study before talking through the development of my intervention.

4 – Intervention

Following the case study, a number of options were considered for their potential to enhance the foods programme at MGS. As discussed in the previous chapter the health and safety practices or Codes or Practice (CoPs), are one of the key lessons students need to learn. Being universal across schools and something that has far less appeal to students than practical cooking lessons it represents an appropriate focus for an immersive technological intervention.

In particular we chose to look at the following areas; hand washing, food preparation, cleaning, dishes and oven management. My initial brainstorm is shown in Table 8 below.

4.1 Idea brainstorm

Table 8 - Initial brainstorm of intervention ideas

	Idea	**Possible Solution**
GAMIFICATION	Develop a gamified version of the existing foods theory programme that includes points or badges for the completion of set tasks. It could potentially include: • cooking using the frypan - a quiz to confirm CoPs • home cook – graded against the criteria • points awarded for research project and presentation • Kahoots or similar developed around the CoPs that contribute to the overall leader board • badges for demonstration of good practice.	**Classcraft** offers a classroom environment where students can complete quests and earn rewards. This could be adapted to create the gamified classroom described but there is some concern from the author that the fantasy elements could clash with the Christian school values. ("Classcraft - Engagement Management System for K-12 Educators," n.d.)
A SCAVENGER HUNT	A gamified scavenger hunt to explore different elements of the foods room or to investigate fat and sugar content in a supermarket would be a fun intervention that incorporates a range of gamified elements while engaging the students in the learning task. Tasks could include things like: • taking a photo with a food that is high in protein and a great source of iron • taking a photo of someone using the hand wash soap.	**GooseChase** is a quality App, designed for team building scavenger hunts, that operates on mobile devices. It is easy to use and with the selfie function the teacher can have regular updates of what each student is working on. ("GooseChase - Scavenger Hunts for the Masses," n.d.)

A Virtual Kitchen	Create a virtual kitchen that allows students to simulate recipes prior to cooking, teaching the key CoPs to succeed. If assessment elements are added this could help reduce the workload for the teacher. Ultimately, the simulator could learn food science to the point where it could accurately predict and show how recipes will turn out based on what the user does in the preparation.	**KFC has** released a virtual reality training game and is an example of how VR could be used to teach the CoPs. ("KFC The Hard Way | Oculus," n.d.) **Lactel,** a simulation where players create a crepe in VR, is another example of how this technology could be used. ("EON Reality INC," 2018)
A VR Cooking Game	Developing a game that requires students to identify and rectify the CoPs in a given storyline has potential. *"The chef has just fallen over with food poisoning and you need to quickly bring the kitchen up to code and prepare for the arrival of customers to the school cafeteria."* The players would clean, shop, prepare and cook food in a time pressure situation. Points and badges can be awarded for completion of tasks and opportunities to level-up can be added. Likewise, the player could suffer injuries or illness if they forget to apply the appropriate CoPs.	**Labster VR,** discussed earlier in this thesis, is a science game that incorporates a similar story game approach to science education. **Job Simulator** uses many of these elements to create a fun game for children, but this would need to be redesigned to take more of an education focus in order to be useful. (Valve Corporation, 2018)
A 360 Degree Classroom	A 360 degree kitchen that jumps from lesson to lesson. For example the homepage shows the teacher in 4 or 5 different spaces. When you view on the teacher, a 360 degree tutorial pops up.	**BECA Mobile VR Tours** use this method to deliver worksite Health and Safety training. This app also has multi-choice questions to test participants (BECA, 2018)
A Flipped Learning Experiment	A flipped learning experiment that incorporates a range of common digital learning tools to allow students to engage with and learn the CoPs in a fun and engaging way outside the kitchen.	**Quizlet** has the potential to enhance the theory lessons as well as engaging the students. ("Learning tools and flashcards - for free! | Quizlet," n.d.) **Kahoot** could be a key part of this experiment, used in class in a competitive way to encourage students to learn the information from the flipped learning tools. ("Kahoot!," n.d.)

4.2 360 Degree Video

As discussed in the early parts of this thesis, VR can fully capture the user to the point where they believe they are in a real world and I believe this has the potential to enhance current education practices. Using 360 degree images and video, it is believed that we will be able to create a realistic looking classroom where students can learn through specific targeted

lessons. This solution addresses the common desire of the foods teachers to use online videos to give students an alternative opportunity to learn the information traditionally taught using demonstration. It also takes it to another level by delivering it in a virtual environment rather than through a computer or television.

"If a photo is worth a thousand words, how many words is a 360 degree photo worth?"(VeeR VR, 2018). 360 degree photos and videos allow the user to not only view the photo in front of them but also look all around, up, down and behind. In essence, when viewing a 360 degree video or still image inside a virtual headset, the user is immersed into a virtual world that looks similar to the real world but with one important exclusion; it doesn't have the distractions of other participants in it. The increased focus that 360 degree video content can provide is highlighted by Harrington et al. (2018) in a study of the difference between two dimensional and 360 degree video content. The authors claim the participants in the 360 degree group were significantly more engaged and exhibited lower unrelated thoughts. This quote, taken from one of the students involved in a study on the use of 360 degree video in Religious education classes, clearly highlights this presence and the increased focus gained through being immersed into a 360 degree world.

> *When reading, I am easily distracted but this allowed me to learn and experience it in a way that was hard to distract me so since all my attention was focused I could 'stand in their shoes' more. (Johnson, 2018, p.233)*

Harrington et al. (2018) claim the use of 360 degree video took the learning from being an abstract experience to one where participants experience "a sense of immersion/presence in the environment" (p.997). The authors concurred that it allowed participants to *experience* and not merely *observe* the surroundings.

On top of the higher engagement levels, there is also evidence that student learning can be increased through the use of 360 degree training. Lau, Lee, He, & Ying (2018), in a study into use of 360 degree video to increase workplace learning behaviour, found that participants showed significantly higher scores in the areas of professional knowledge and problem solving. They reported no significant gains however, in independent learning and critical reflection. The lack of effect for critical reflection, however, could have been a result of the questions used, as highlighted by Johnson (2018); both the questions and the assignments given to guide the viewing experience are important for encouraging deeper thinking.

A range of limitations are discussed in the literature, and one area of concern is how the students will access the technology. Digital solutions could be restricted, for example,

through a lack of access to suitable devices, headsets or internet access. The process adopted by Johnson (2018), where the VR viewers were issued for short term use via the library is a good one. This could be either a stand-alone device like the Oculus Go ("Oculus Go: Stand-alone VR Headset | Oculus," n.d.), a headset that students can use with their own mobile devices or a fixed system in the library. In the case of MGS, this library system could work well, but a simple VR Viewer like the Google Cardboard, as part of the required stationery for the class, also has potential (Johnson, 2018).

Another problem, especially while the video quality is still developing, is the issue of motion sickness. The effects can be reduced by keeping the camera stationary for recording, but this will not prevent sickness for all participants. Johnson (2018) suggests having a computer link available for those who struggle with VR sickness, allowing the capacity to view content on a computer for these participants. Whilst this allows the users to watch the videos and rotate the screen, I feel it would be disappointing for the user to not have the heightened presence the VR viewer provides.

4.3 360 Degree Classroom

The concept of the 360 degree classroom is that we give the students an immersive experience where they are able to learn the critical health and safety messages termed the Codes of Practice. The core skills like how to wash your hands, prepare food, cook, serve and clean up are highly important and are not something that can be left to one-off demonstrations. In the 360 degree environment, participants will have the opportunity to look around the room as well as open hotspots that will reveal photos and safety information relating to different aspects of the room. The participants will also be able to view video tutorials that incorporate multi-choice questions to reinforce the in-class learning.

It is unlikely that teachers will forgo the use of demonstration, but it is believed that with the 360 degree VR Classroom system students will have access to multiple learning opportunities; that support and enhance the current programme and are available as, and when needed by the students. The ability for the students to learn in a virtual environment should be highly motivating and the ability to learn in a fully immersive VR headset could help increase focus by removing regular classroom distractions.

4.4 Potential Development Options

In order to develop a VR Classroom for use in the user study, I first recorded a number of 360 degree still images and short tutorial videos with the teacher from Middleton Grange School (MGS). I then researched potential tools that could be used to create the VR Classroom, summarised in Table 9.

Table 9 - Comparison of potential ways of editing a VR classroom

	Google Tour Creator	**Unity**	**InstaVR**	**ThingLink**
BENEFITS	• Free • Simple to use • Adds hotspots for still images, commentary, and text • Similarities with other Google products • Can be be viewed in multiple platforms	• Free with branding • Versatile • Has a number of features available • Capable of producing high quality outcomes • Adaptable to multiple platforms	• Free for basic version with branding • Fully integrated web tool • Adds hotspots for still images, text, commentary and 360 degree video • Can be easily packaged into separate app	• Reasonable prices for teachers $35 USD / Year • Adds hotspots for still images, text, commentary, video and 360 degree video • Professional looking presentations
LIMITATIONS	• Fixed to Google's poly library; can share but not export as separate application • No view on link options; needs to have touch input • Does not run or link to video or 360 degree video • No quiz option	• Requires technical knowledge of Unity • Coding skills required • Steep initial learning curve • Longer time to develop	• Limitations on free version including full branding in 360 degree images and start screen • Not a user friendly interface • Very expensive • 1GB maximum file upload on free version limits number of videos • No quiz option	• Does not package into one product for easy use in VR viewer • Requires regular internet as linking to online content • YouTube video links don't start without touch input • Comes with class tools to track student usage • Free version has no 360 degree video content • No quiz option

4.4.1 Tour Creator

Tour Creator ("Tour Creator," n.d.), is a Google tool developed to add captions and other images to 360 degree images, thereby creating virtual tours. The things that stood out to me with Tour Creator were its simplicity and familiarity of use. The ability to use a Google product was appealing to me as a researcher, and would also make it easy for teachers to adopt. Being free and simple to use, it is something that could be used by both teachers and students. The two images below show how Tour Creator gives a simple but professional outcome. The web based layout shown in Figure 8 is effective and the subtle text box to display the text looks professional and visually attractive. The view shown in Figure 9 is clear and the text is well positioned and appropriately sized to make reading comfortable. Due to not being able to link to video or 360 degree video files Tour Creator was not chosen for this project.

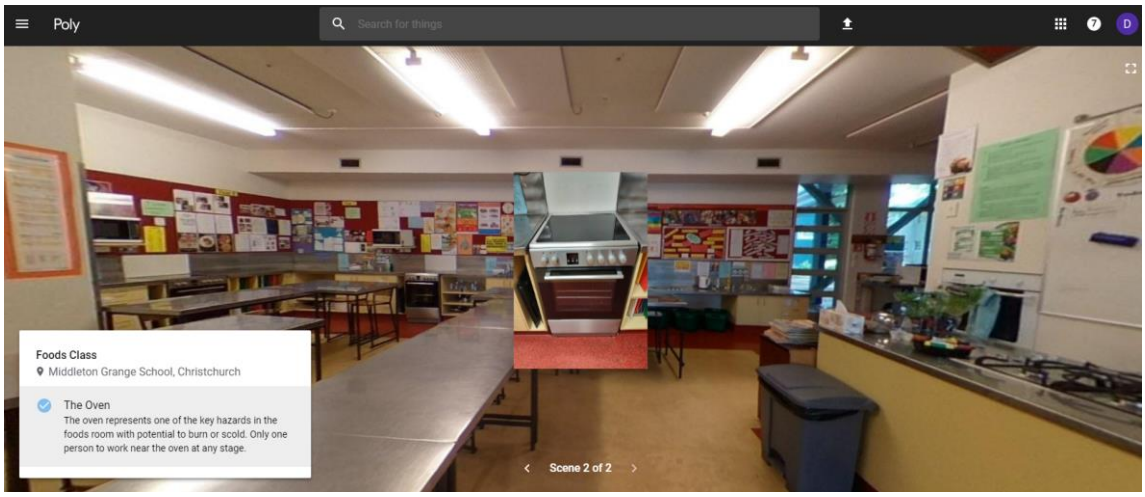

Figure 8 - Screenshot PC Tour Creator 360 degree classroom viewed from Google Poly in Google Chrome

Figure 9 - Google Cardboard view on an Android cellphone

4.4.2 InstaVR

InstaVR ("InstaVR," n.d.) is a professional grade online editing tool that is used by many major companies to develop virtual tours. The quality of product that can be developed with limited technical knowledge is excellent. The customization is easy and flexible as shown by the image inserts in Figure 10. The ability to package it to multiple platforms, including as a one off application for Android, is appealing.

The cost however, made InstaVR unrealistic for this stage of my study, with a one off app selling at around $1000 NZD. The file limit on the water-marked, trial version restricts the amount of video files you can use.

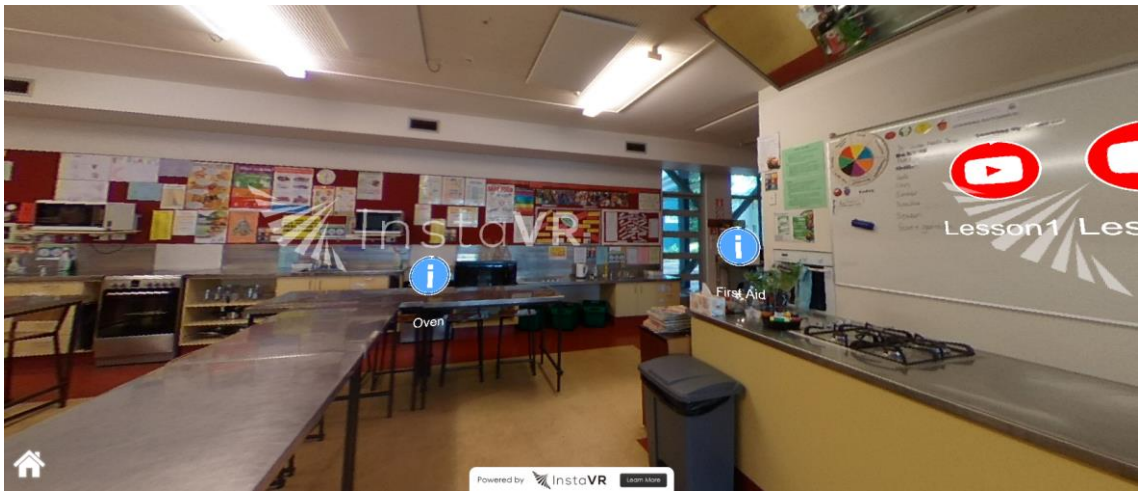

Figure 10 - InstaVR

4.4.3 ThingLink

ThingLink is described as "Real world in the cloud**.** The easiest and most cost-efficient way to build real-world learning experiences without logistical hassle. Suitable for online lectures, technical and vocational education, workplace learning, campus tours, and virtual field trips." ("ThingLink," n.d.) ThingLink has a number of customizations that give it a professional look. At $50 NZD a year for a teacher licence, it is affordable for school use and is worth considering for teachers and students to present content. The custom designs, like the oven popup shown in Figure 11, give the tool a higher level of professionalism than the others compared. An inability to work without a strong internet connection and an inability to connect to video content made it unsuitable for this project.

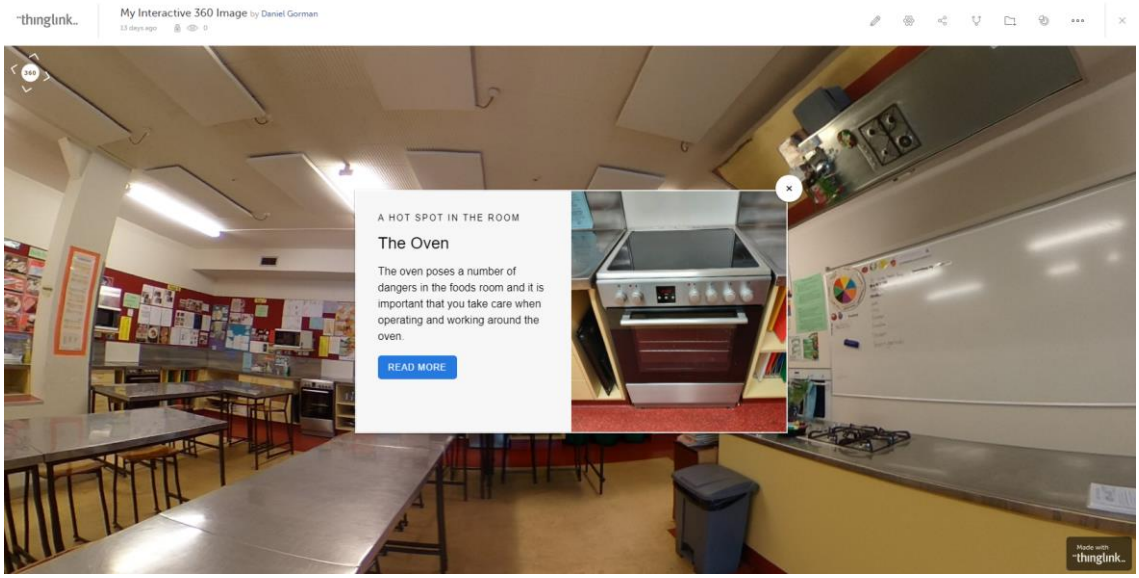

Figure 11 - Thinklink - web version

4.4.4 Unity

Unity ("Unity," 2019) was chosen as the platform that would combine the greatest number of design elements and provide a resource that was able to be used beyond this research. It was also the only tool that could be used to add in quizzes making it the most useful for this project.

4.5 System

The VR classroom was developed in Unity for use in the Oculus Go ("Oculus Go: Stand-alone VR Headset | Oculus," n.d.). The design plan shown in Figure 12 was used to guide the design.

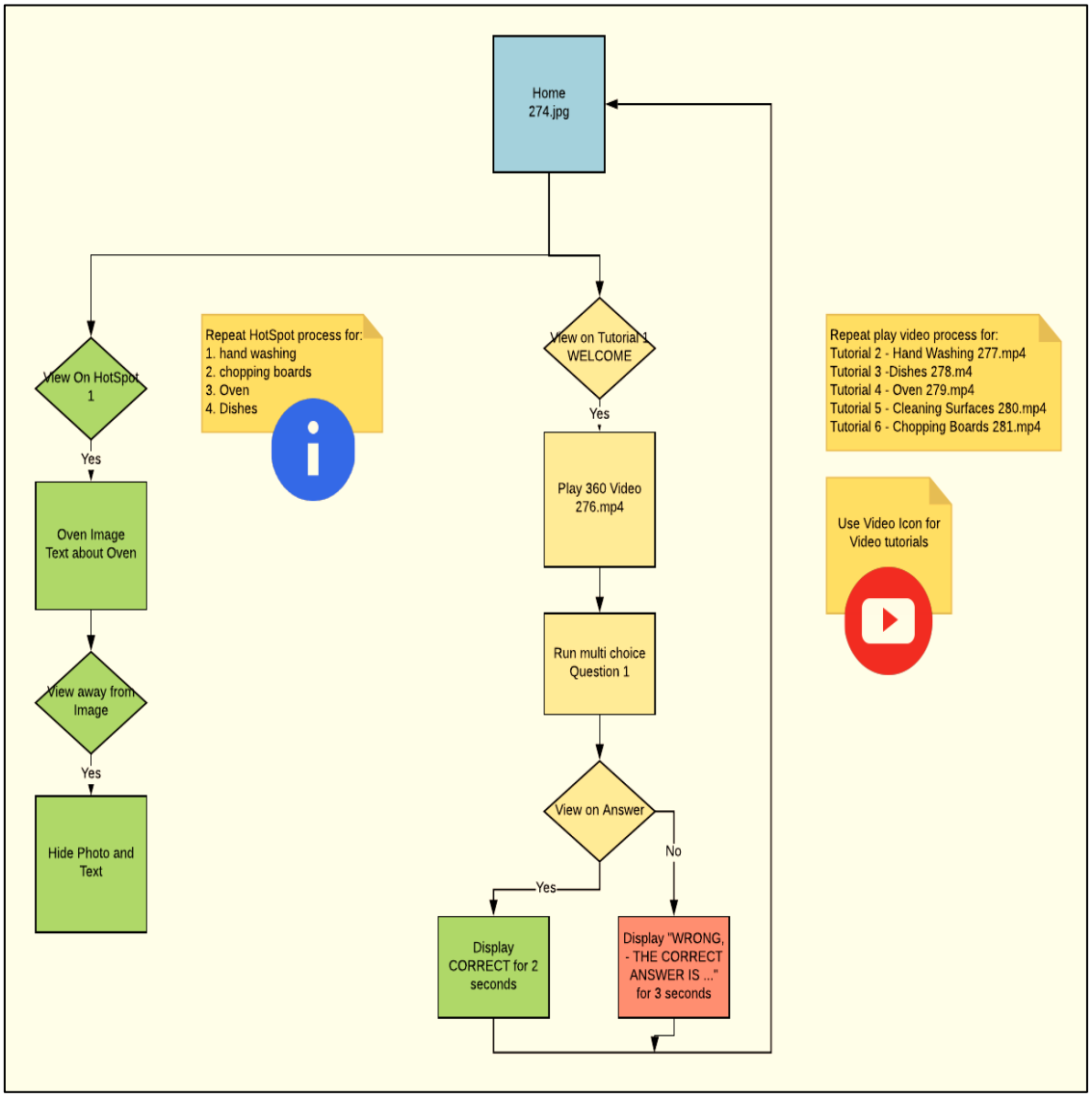

Figure 12 - Design flow chart for prototype 360 degree classroom

The interface was built around a 360 degree still image of the school kitchen and a range of hotspots, that linked to different content, were added to this homescreen image. The homescreen shown in Figure 13, shows an example of the information hotspots as well as the video lesson hotspots shown on the whiteboard.

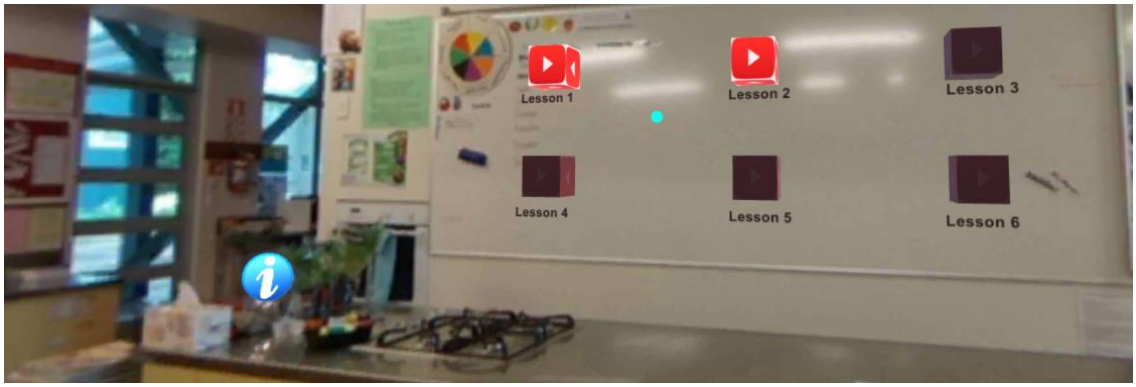

Figure 13 - VR Classroom - homescreen with information hotspots and video links showing

The information hotspots were designed to show learning information as well as a photo above key areas of the classroom. The canvases (Figures 14 and 15) were programmed so they would appear over the top of the hotspot icons.

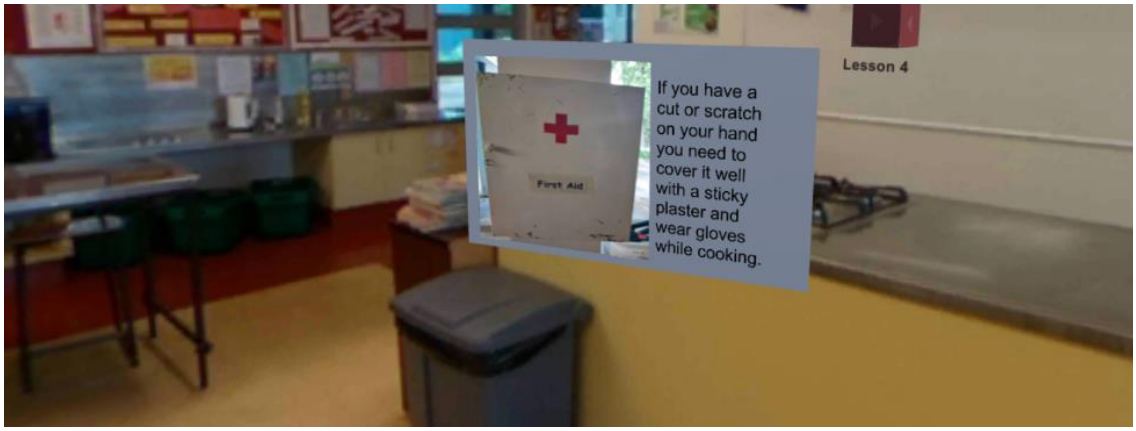

Figure 14 - The homescreen with first aid cabinet hotspot open

Figure 15 - The homescreen with the oven hotspot open

The video icons loaded separate scenes of the teacher demonstrating key health and safety lessons that were built using the 360 degree videos. Accessing the hotspots (trigger boxes)

replaced the still homescreen image inside the viewer with the selected tutorial video. Following the video, there was a single, multi-choice question that allowed the students to test their understanding of the tutorial. In order to use the questions as a teaching tool if the multi-choice question was answered correctly they students would get a response saying correct, and then they were returned to the homescreen. After the first iteration of the design to help teach the key messages the design was changed so that when a student selected an incorrect answer it was removed and they were prompted to answer again until they selected the correct answer.

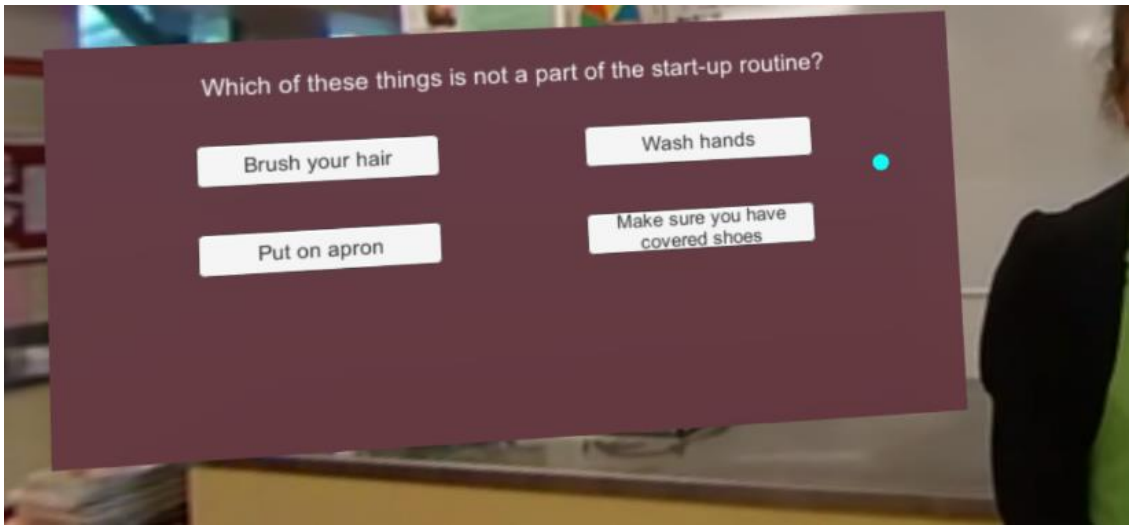

Figure 16 - The end of the video for Lesson 1 with the multi choice video quiz showing

The use of a gaze-click method was adopted due to the desire to create a product that was economical for implementation into the classroom via smartphones. The gaze-click method allows the user to interact with and move between screens without the need for a hand controller. When the cursor, the blue dot shown in Figure 16, is held over the trigger point the cursor grows for 3 seconds and then actions the click.

With the final design, we chose to use The Oculus Go (Figure 17), a stand alone VR viewing device. At a cost of approximately $400 NZD it is a realistic option for schools and also adds a number of other benefits: it is an all-in-one solution, removing the issues associated with having to use your mobile phone and a separate headset; it has high quality video and sound; it is comfortable for younger users as well as adults; and it is easier to develop the VR Classroom as the design does not have to be generic for use on various Android devices.

Figure 17 - Oculus Go, as used in the user study

One of the key issues in the system development was creating a final file that was small enough to fit and run on a smart phone or the Oculus Go. The size of the six video files was nearly 5 GB and the Oculus Go has a maximum APK file size of 1GB with the ability to add an Opaque Binary Blob (OBB) expansion file of up to 4GB. The goal was to create an APK file of under 1GB. With the initial attempts to reduce the video size, the resultant video quality was unusable. Eventually Handbrake ("HandBrake: Open Source Video Transcoder," n.d.), a video transcoder that allowed us to drastically reduce the video file size with only minor visible effect to the video quality was discovered. As an example, the file size of one video was reduced from 696MB down to 14MB.

One of the other issues was completing all of the links in the multi choice questions. A number of bugs occurred that caused the VR Classroom to freeze and prevented the user from inputting the answers. These issues were all fixed in the final iteration used for testing, but somewhere in the final stage of development, the videos developed a lag. It was decided, however, to use this iteration as the links from questions back to the home page were vital to the testing

In the next chapter, I discuss the user study where I test the above VR Classroom with a class of students.

5 – User Study

The VR Classroom was designed and developed for the students at MGS, and it was fitting that I was able to run a trial of the intervention with Year 7 students at the school.

5.1 Methods

The concept of a User Study is that the researcher observes someone from the potential demographic using your product in an attempt to identify any issues with their design. The usage can be evaluated using a range of metrics described by Tullis and Albert (2013)as powerful tools for evaluating your designs. Kuniavsky (2003) recommends the use of micro-usability tests, as early as possible in the design process, to allow the developer to better understand the needs of the end-user and quickly identify potential problems with the design.

To gather data on how the participants felt about the product, I used a post-study questionnaire that includes the System Usability Scale (Brooke, 1996), and a series of engagement questions. Tullis and Albert (2013) list "creating an overall positive user experience" (p.46), as one of ten usability study scenarios, and highlight the key metrics for assessing the intervention as "self-reported metrics" and "behavioral & physiological metrics". Self-reported metrics are those that are reported by the user, but in order to make sense of this data, carefully selected tools are required. One of the most widely known tools is a Likert Scale questionnaire, a multi-choice system that allows users to grade how much they agree or disagree with a statement. The scale consists of an odd number of arguments, typically 3, 5, or 7. For my study, I used the following five part Likert Scale for all of the questions:

1. *strongly disagree*
2. *disagree*
3. *neither agree nor disagree*
4. *agree*
5. *strongly agree.*

The use of Behavioural & Physiological Metrics involves looking at how participants respond to an intervention, including monitoring where they are looking and what they are saying. For this study, I recorded comments as said by participants and noted down observations about behaviours.

5.1.1 System Usability Scale

The first ten statements in my questionnaire use the all-positive version of the System Usability Scale (SUS), as proposed by (Sauro & Lewis, 2012). This questionnaire, an adaptation of the original ten question System Usability Scale developed by Brooke (1996), uses all positive questions as opposed to the positive, then negative, format proposed by Brooke (1996). Sauro & Lewis (2012) recommend new researchers use the positive format "because respondents are less likely to make mistakes when responding, researchers are less likely to make coding errors, and the scores will be similar to the standard SUS" (p.210). On top of these reasons I chose the all-positive version because the chance of confusion is increased by the younger age of participants in my study. The SUS is described by Brooke (2013) as a measure of "the user's subjective view of the usability of the system" (p.33), and this matches with the intent of my study to get the participants emotive responses to using the system. Table 10 shows the all-positive version of the SUS adapted for use in this study.

Table 10 - All positive SUS as used in this study

System Usability Scale (SUS)		Strongly Disagree				Strongly Agree
1	I think I would like to use the system frequently	1	2	3	4	5
2	I found the system to be simple	1	2	3	4	5
3	I thought the system was easy to use	1	2	3	4	5
4	I think that I could use the system without the support of a technical person	1	2	3	4	5
5	I found the various functions in the system were well integrated	1	2	3	4	5
6	I thought there was a lot of consistency in the system	1	2	3	4	5
7	I would imagine that most people would learn to use the VR Classroom very quickly	1	2	3	4	5
8	I found the VR Classroom very intuitive	1	2	3	4	5
9	I felt very confident using the VR Classroom	1	2	3	4	5
10	I could use the VR Classroom without having to learn anything new	1	2	3	4	5

5.1.2 Engagement and Motivation

The focus of my study is to determine how effectively the VR classroom engages learners. Engagement, for the purposes of this study, describes the ability of the intervention to encourage the users to explore, interact and learn. Motivation and satisfaction are two areas, highlighted in literature, that are closely related to engagement. Wang (2015), in a study of "Kahoot", tested for both engagement and motivation with five different statements while

Barneche, Luis, Hernández, & Ez (2015), in their study of a virtual museum tour, used two statements specifically designed to explore satisfaction. Table 11 highlights the statements used by the above authors and shows how they have been adapted for my research.

Table 11 - Questions 1-4, (Wang, 2015, p.11) & (Barneche, Luis, Hernández, & Ez, 2015, p.397)

AUTHOR | INTENT	ORIGINAL STATEMENT	ADAPTED STATEMENT
(Wang, 2015) Engagement	I was engaged while playing.	I was engaged while in the VR Classroom.
(Wang, 2015) Engagement	*I was emotionally engaged while playing .*	*I did not use this statement as I felt the difference between this and the previous statement would be confusing.*
(Wang, 2015) Engagement	It was fun to play the game.	It was fun to visit the VR Classroom.
(Wang, 2015) Motivation	I wish Kahoot! was used in other lectures.	I wish we could use this sort of activity in other subjects.
(Wang, 2015) Motivation	I am more positive towards the topic after playing the game	I would be more positive about foods if we used this technology.
Barneche et al., (2015) Satisfaction	Desire to repeat with another subject.	I would like to have another go in the VR Classroom.
Barneche et al., (2015) Satisfaction	General impressions of the experience.	Overall I was impressed by the VR Classroom.

5.1.3 Game Engagement Questionnaire

I also used two statements from the Game Engagement Questionnaire (GEQ) (Brockmyer et al., 2009). This is a 19 point survey designed specifically to explore participant engagement in games. Whilst the GEQ shows promise as a way of measuring engagement, only aspects of it suited my study due to the limited time the participants would spend using the VR classroom. The statements chosen were:

- It felt real in the VR Classroom
- I lost track of time *in the VR Classroom*

5.2 Testing procedure

Sudents from a Year 7 foods class at MGS were tested in the third week of Term 1, 2019. This was an ideal time because the project aimed to develop a tool that could assist with teaching essential food safety messages. Whilst there is an ongoing need for safety instruction, this content is critical early in the foods programme. Because the learning contained in the VR Classroom was relevant to the teaching programme the testing was

completed as part of the regular classroom programme, simulating the situation the product was designed for. In total, I tested 12 participants, 5 male and 7 female. The process for testing followed this pattern.

1. A pair of participants was accompanied from class to the teachers' office area by Assistant 1.
2. I explained the participant information that outlined the testing tasks
3. Assistant 1 and I then moved the participants from the office to the testing space (Figure 18) in the corridor and sat them on a swivel chair.
4. The participants were fitted with an Oculus Go Headset.
5. The participants completed the tasks outlined in the information sheet.
    a. Look around the VR classroom space.
    b. View on the (**i)** (information) spots and read what they say.
    c. Watch video Lesson 1.
    d. Complete the multi-choice quiz after the video.
    e. Take off the headset.
6. The participants then moved across to Assistant 2 to complete the questionnaire on individual iPads (sample shown in Figure 19).

Figure 18 – Assistant 1 and 2 demonstrating the testing environment

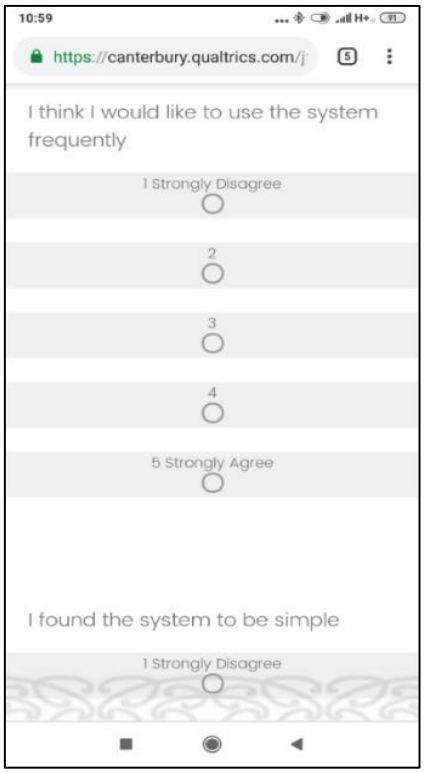

Figure 19 - Example of mobile qualtrics tool used for testing

5.2.1.1 Ethics Approval

Prior to starting the case study my Low Risk Ethics application [Appendix G] was approved by the Director of the Human Interface Technology Lab NZ and this was subsequently accepted by the University of Canterbury Educational Research Human Ethics Committee. (2018/09/ERHEC-LR) [Appendix H]

5.3 Results

In the results section, the data is presented in the three categories discussed in the methods section: the System Usability Scale (SUS), engagement and motivation, and the Game Engagement Questionnaire (GEQ).

5.3.1 The System Usability Scale (SUS)

The System Usability Scale was calculated using an adaption of the "sus_calculation.xls" (n.d.), downloaded from the companion website of Measuring the User Experience (Tullis & Albert, 2013). I adapted the formulas to allow for the change to an all-positive format. Figure 20 shows the mean scores of participants graded against the mean SUS score of 68, which is based on thousands of collected datasets (Sauro & Lewis, 2012).

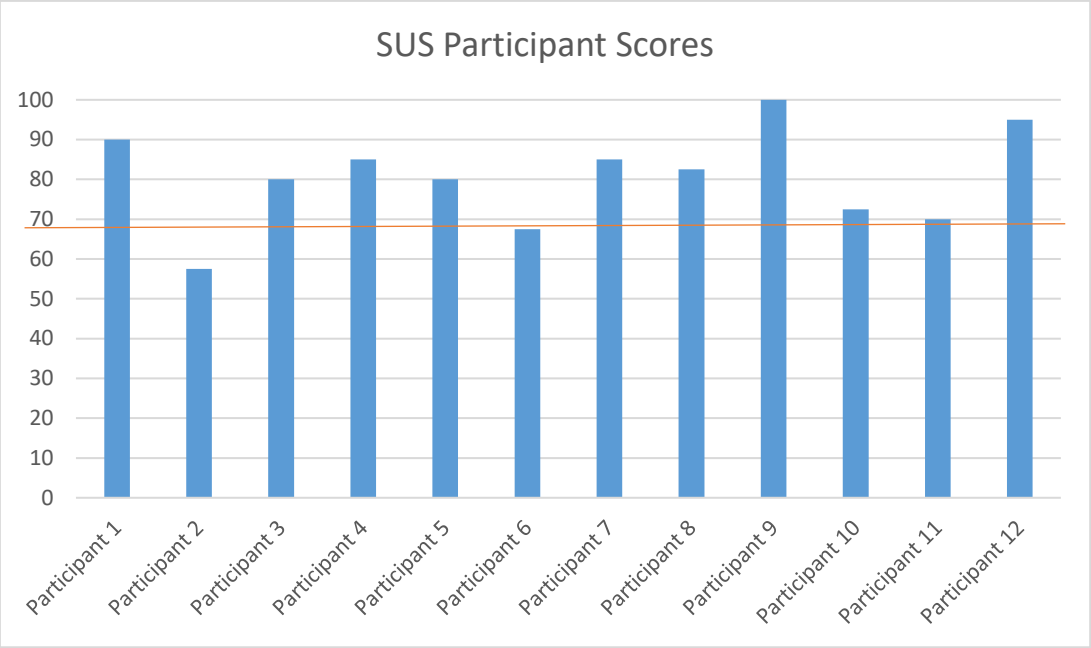

Figure 20 - Overall SUS calculations

This chart shows that 10 out of 12 participants ranked the VR Classroom as better than the established average of 68.

Similarly, Bangor et al (2009), as cited in Tullis and Albert (2013, p.139) suggest the following scale for interpreting SUS scores.

- <50: Not Acceptable
- 50-70: Marginal
- >70: Acceptable

With this scale, there is the inclusion of a Not-Acceptable range of below 50. Applying this scale, shown in Figure 21, the results show 9 out of 12 participants rated the VR Classroom as Acceptable, and 3 participants rated it as Marginal.

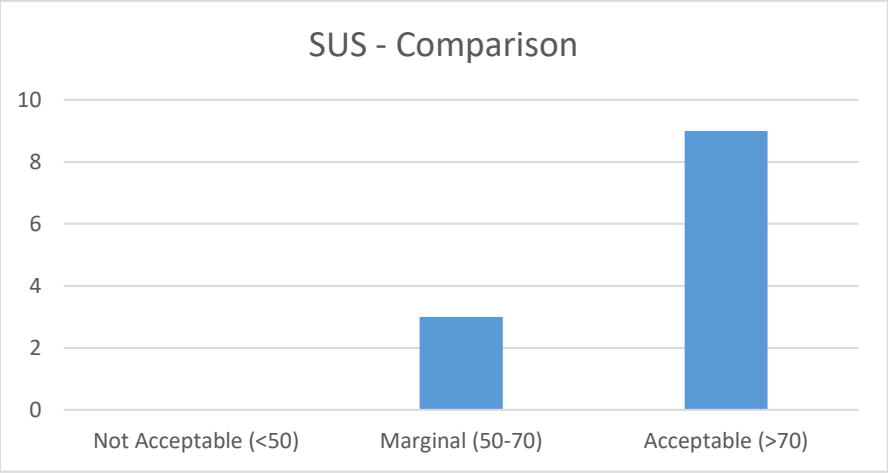

Figure 21 - SUS Scale as suggested in (Tullis and Albert, 2013)

Thomas (2015) proposes a mean score of 80.3 as the critical point where users will tell their friends about your product. The results from my test give an overall mean SUS score of 80.4 and the anecdote below, recorded 15 minutes after the completion of the testing, supports Thomas' notion:

> *Having finished packing up after the testing, I walked across to thank the classroom teacher, who had just finished her end of day duty by the road. She explained how one of the students not part of the user study class had come running up to her saying, (as she switched to an imitation of an excited child's voice) "Mrs ()!, Mrs ()! I heard that you were doing some cool VR thing in your room and it was really cool. Can we do this in our class too?*
>
> *(Research notes 19 February 2019)*

Another measure for exploring the SUS data is to convert it to a percentile (Sauro & Lewis, 2012). With this method, the mean score of 80.4 translates to a percentile ranking of 88, meaning users believe it is more usable than 88% of products. Figure 22 shows how low the lowest score of 57.5 was, sitting it in the 19th percentile. With only one other score ranking under the 50th percentile, we can say that 10 out of 12 participants felt the product was easier to use than average.

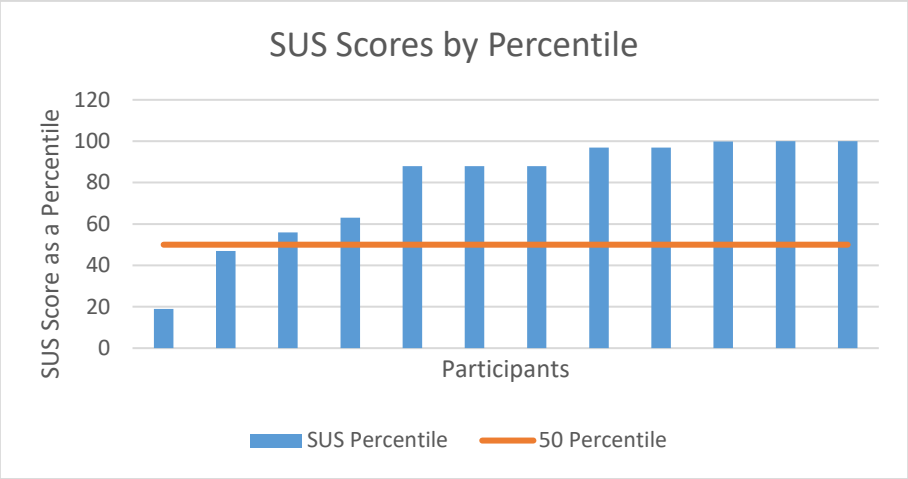

Figure 22 - SUS scores as a percentile

As of yet, there is no benchmark data for SUS tests completed with VR; therefore, I used the overall mean for my discussion. This said, in a recent study comparing the Oculus Rift and Samsung Gear VR, Webster & Dues (2018) reported that both samples in the study had means of 82. 7 and 82.9 (p.8), much higher than the established overall mean of 68. When compared to these means, and considering the higher benchmark means in studies involving more interactive tools like iPhone-78.5 or the Wii-76.9 (Sauro & Lewis, 2012, p.205), the mean SUS score of 80.4 in this study appears to be consistent with these studies. It also indicates that the benchmark mean for VR is likely to be higher than the overall mean of 68.

5.3.1.1 SUS by gender

There were a total of seven female and five male participants, and the following charts show the SUS scores when comparing male and female responses. Figure 23 shows that the scores from male participants was similar to those received from female participants. In Figure 24, the mean scores and confidence intervals show both groups are similar.

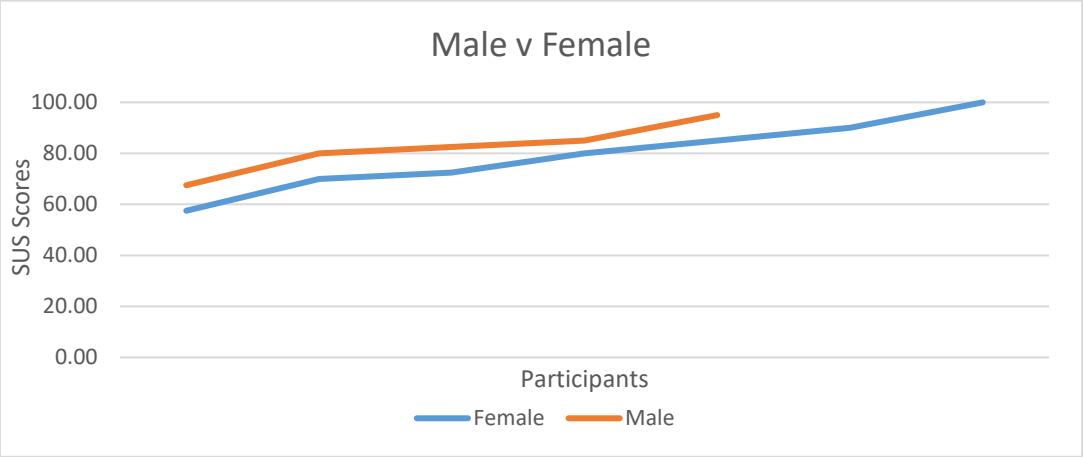

Figure 23 - Male v female SUS mean

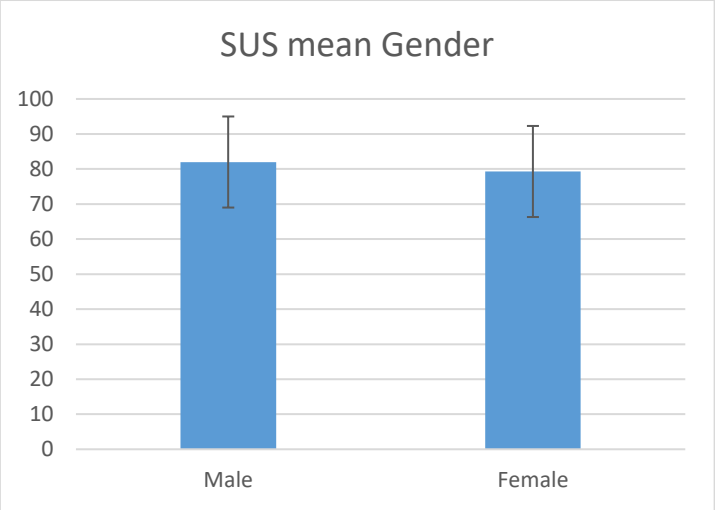

Figure 24 - Male v female SUS with confidence

When analyzing SUS data by gender, with the mean score of male and female participants 82 and 79.3 respectively, they appear to be very similar. There is no significant difference, at $\alpha = .05$, between the mean SUS scores between male and female participants (two-tailed t test $p = .720$). An *F* test, to determine if the variance between genders was different, was also not significant at ($p = .520$). There is a larger range in the scores for female participants, with a difference of 42.5 (57.5-100) compared to 27.5 (67.5-95) from male respondents. Ranges included both the highest and lowest scores.

5.3.1.2 SUS by Statement

Although the SUS is designed to be read as a total score, it is interesting to look at the individual statements to find areas to focus development.

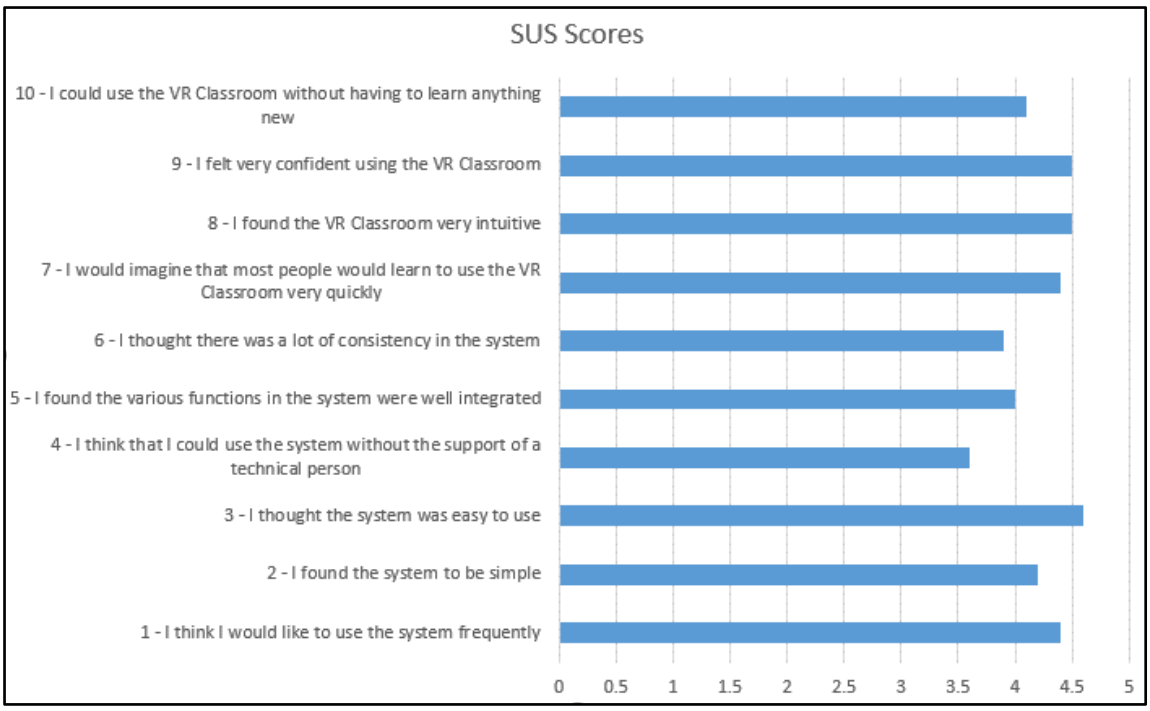

Figure 25 - SUS individual questions

Figure 25 shows that Statements 4-6 are the lowest, with the lowest ranked - Statement 4 (I think that I could use the system without the support of a technical person). The results for Statement 4 show some ambiguity when following on from Statement 3 (I thought the system was easy to use), which was given the highest overall score. You would expect if the VR classroom were easy to use then you would not need the support of a technical person.

5.3.2 Engagement

Statements 11-16 targeted motivation and engagement, and the responses shown in Figure 26 highlight a high level of both.

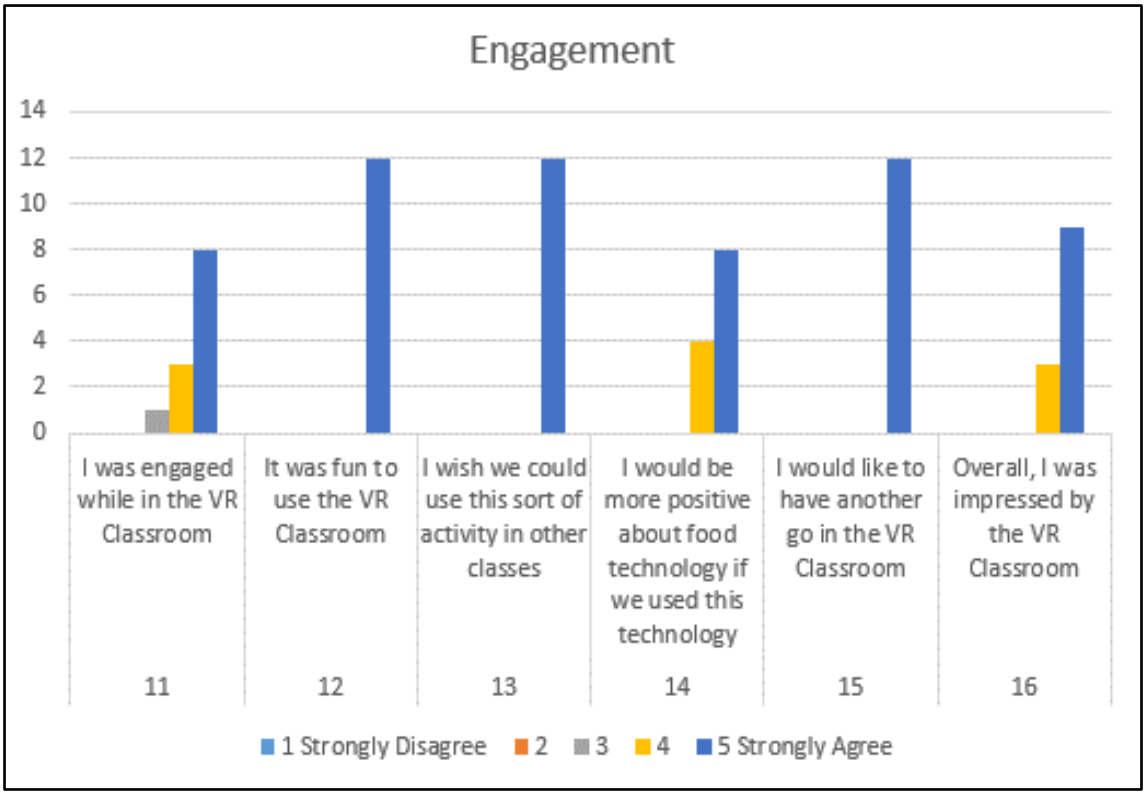

Figure 26 - Engagement chart

Statements 12, 13 and 15 received the top ranking of Strongly Agree from all participants. Statement 11 (I was engaged while in the VR Classroom) was the only Statement to get a grade lower than a 4, with one participant neutral. Statement 14 (I would be more positive about food technology if we used this technology) was always unlikely to get 100% of participants scoring Strongly Agree as it is hard to compete with a subject that involves making and eating food. Considering this, 8 out of 12 participants still Strongly Agreeing with this statement was a positive response.

During the testing, I noted participant's impromptu comments that supported the interest in the VR Classroom. Three participants said "Wow" soon after putting the headset on, and two of them also added "This is cool". The predominant behaviour observed was a high level of focus, similar to that shown in Figure 27. One boy was particularly excited and spent a good portion of time spinning on the chair while looking up and down to check out the whole space.

Figure 27 - Assistant 1 - testing the VR Classroom

5.3.3 Game Experience Questionnaire (GEQ)

The two statements used from the game experience questionnaire received some of the lowest ratings. Nevertheless, as we can see in Figure 28, 8 out of the 12 participants still strongly agreed with the statement that it felt real in the VR Classroom, a sentiment that was supported by two unexpected observations. Two separate students commented on how strange it was looking down, as they felt like they were up in the air. I also observed one participant jump saying "UGH, it's (teacher's name) as the video started and suddenly there was a person in the classroom with them.

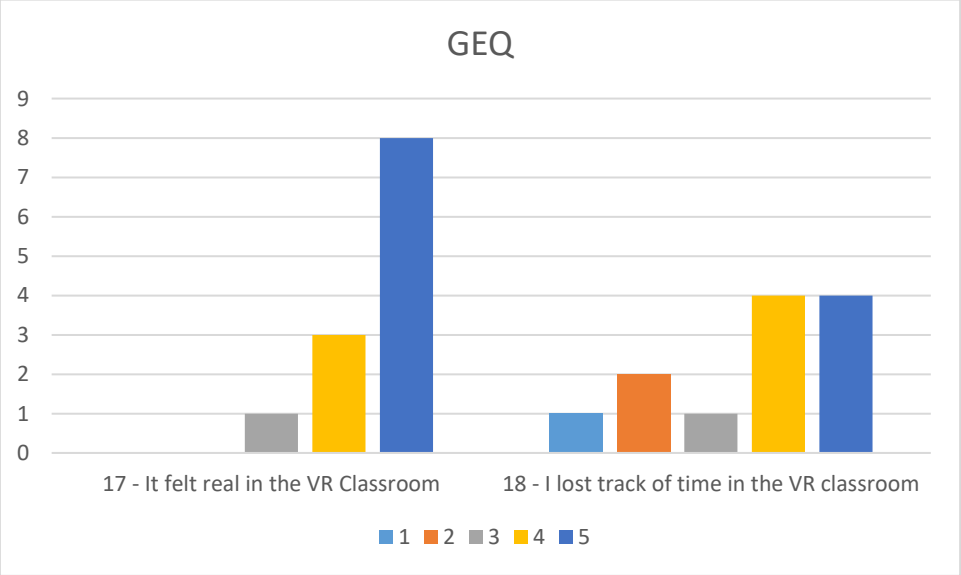

Figure 28 - Game Experience Questionnaire

Statement 18 (I lost track of time in the VR Classroom) was the lowest scored statement in the questionnaire and because of the wider spread of responses it is one of the few statements that can be analysed using the "top two boxes" grading system as proposed by Tullis & Albert (2013). In this method, the top two boxes are counted as indicators of agreement and the Neutral and two bottom boxes are counted as disagreement. This calculation still resulted in a positive response to statement 18 with 8 out of 12 participants agreeing that they felt they lost track of time while in the VR Classroom.

5.4 Discussion

5.4.1 Validity of Data

The first point to discuss is the validity of the data. Some critics may argue that the age of the participants, especially in relation to the SUS testing, could have skewed the data. Comprehension of questions was one of the issues discussed prior to the test, and something that became more complex the more I attempted to unpack it. Two statements that had the potential to be confusing for the younger participants were:

5 - I found the various functions in the system were well integrated

6 - I thought there was a lot of consistency in the system

As a precaution I shared the statements with the classroom teacher prior to the testing and he/she indicated that they felt that the students were all highly literate and that the statements were appropriate. In preparation for the testing, when discussing how my assistant could offer support if participants did not understand, we attempted to define the two statements. It became apparent that the statements are deliberately subjective, and whilst there are likely discrepancies in understanding in the data, the same applies to data attained from adults. This is likely one of the reasons Brook (1996) referred to it as a quick and dirty usability scale and why the SUS is designed to be read as a whole rather than as separate entities.

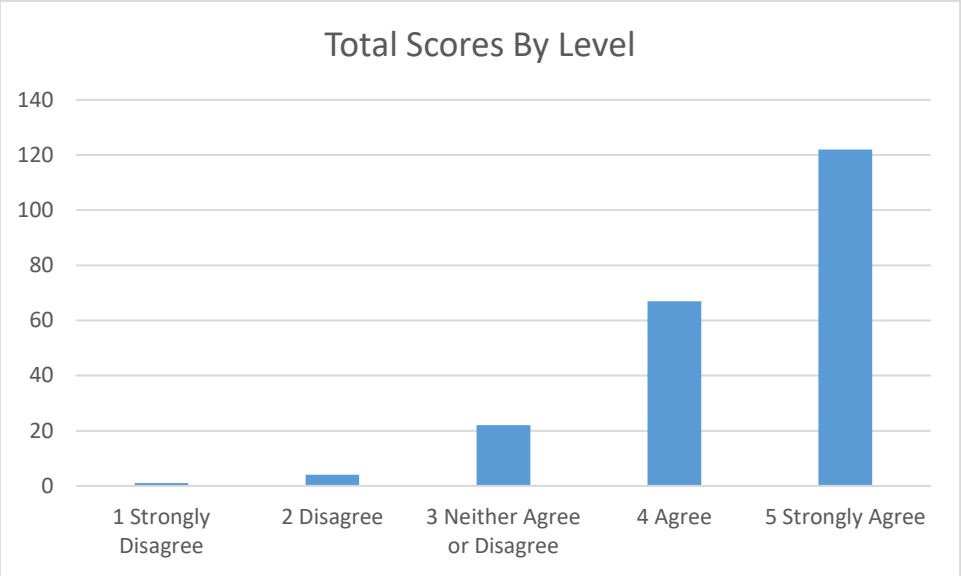

Figure 29 - Total Scores by Level of Agreement

Another argument is that younger participants could be less objective in their responses, and when comparing all the data in a top two box method (Tullis & Albert, 2013), the data appears to support this notion. The total responses from participants are very positive, with 189 agreeing and 27 either neutral or disagreeing with the statements. The ratio of scores in each of the levels of agreement are shown in Figure 29, and this clearly shows the positive trend of responses. Although this may look like it is because of the younger participants I argue, that adults also tend towards giving positive responses, a fact supported by the overall mean historical SUS score of 68.4. The student responses are also comparable to adults when you compare the mean of this study at 80.4 to 82.7 and 82.0 mentioned in a recent study by Webster & Dues (2018).

I believe that the responses to Statement 18 (I lost track of time in the VR Classroom), shown in Figure 29 above, which show a wide spread of responses across all areas of the 5 point scale, also support the students' objectiveness. When reviewed, it makes sense that the participants would have mixed responses to this statement because the GEQ is designed for participants who have had spent many hours playing a game whereas in this study, there was only 4-5 minutes of exposure to the VR Classroom. On top of this, when answering the questionnaire, the participants did not know how long they had been using the VR classroom for. For future iterations of this test, I would suggest the question is re-worded to include a time reference, perhaps like the one below:

> *It felt like I was in the VR classroom for less than 4 minutes*

This would allow for the participants to be able to respond to this statement with a reference to time and could give similar data to the intent of this GEQ question.

5.4.2 Engagement

This research specifically asks:

> *How can immersive technologies be used to enhance food-based education in New Zealand secondary schools?*

The results give us some insights into the potential of the VR Classroom to enhance food-based education. As discussed in previous chapters, I chose my questionnaire questions from surveys specifically focused on engagement and two other areas closely related to engagement, motivation and satisfaction. Statement 11 (I was engaged while using the VR Classroom), specifically asks participants to grade how engaged they felt, and 8 out of 12 participants strongly agreed with this statement. Of the other 4 participants, 3 agreed with the statement and one responded as neutral.. Statement 11 was the lowest ranked of the six statements in the engagement section, and is probably an honest reflection of what was observed. In my journal, I noted that 4 participants were distracted or moving around while using the VR Classroom , including one participant who said they were not watching during the video. This suggests the findings of Makransky et.al. (2017), that VR could be too distracting, was probably true for these participants. However, in one sense they were engaged; it was just that their focus – exploring the environment – was different from the intent of the test.

The other engagement statements support the fact that students enjoyed the experience and the potential of the VR Classroom to engage. One hundred per cent of participants strongly agreed that it was fun (Statement 12), wanted to use this sort of activity in other classes (Statement 13), and wanted to have another go (Statement 15). Nine participants strongly agreed and three participants agreed that they were impressed by the VR Classroom (Statement 16). When asked if they would be more positive about food technology if they used this sort of technology, 8 out of 12 participants strongly agreed and 4 agreed. This was a high response considering how much enjoyment is typically accredited to a subject dedicated to the preparation and consumption of food.

The students' engagement levels were interesting to observe, prompting the question of what engagement is and how do we focus participants on the task at hand? I have mentioned that a number of participants were very interested in the technology, but not necessarily engaged

with the given task. Their time was spent looking around and exploring the VR Classroom rather than focusing on reading the information displays or watching the demonstrations. This raised an interesting question; if the teacher is no longer looking at the students, how can they encourage students' attention during the lesson? One way this could be achieved is through the addition of learning intentions, statements that give the students information about what they are supposed to be learning prior to the learning activity. This could be as simple as giving a few questions prior to using the VR Classroom or even at different stages such as the start of each tutorial video. Likewise, there is huge potential to enhance the experience through the addition of game elements like badges for completion of quests, leader-boards, battles (or games), and badges or points for attaining certain knowledge. This could make learning more engaging and also provide an opportunity to guide the user towards the necessary learning.

Discrepenceies in the design of the VR Classroom may have affected the overall engagement for the user. I noted twice that participants had concerns about the distance to the floor. In review, it was because the 360 degree images and videos were recorded with the tripod set to an average height of a 12 year old student in a standing position, approximately 140 cm off the ground, but when we tested the VR Classroom the students were sitting in a swivel chair with an approximate eye height of about 100 cm. This gave them the perception that they were 30-40 cm higher than they actually were, and when looking down it appeared the floor was below where they knew it to be. This effect could distract from the realism of the VR Classroom; but conversely, the fact that they found it unsettling meant that they had a sense of realism because they were responding in a way that showed they were frightened to reach down due do to feeling that they were floating in space.

A second observation that showed a sense of realism was when Participant 5 spoke in a surprised voice as if they had been given a fright, saying "Ugh, it's (teachers' name)". When transitioning from the homescreen to the first tutorial video, the participants were surprised to find a person moving on the screen, effectively in the room with them. Finding a way to fade the video in over the still image could provide a solution that allows the characters to arrive in the VR space without surprising the viewers.

It is impossible to say from this study whether the positive responses indicate the effectiveness of the VR Classroom or a general interest in VR and the novelty factor it offers. It is clear, however, that the excitement and willingness of participants to explore the VR Classroom highlights the potential for a VR Classroom to motivate students.

5.4.3 System Usability Scale

While SUS was intended as a measure of overall user satisfaction, and the overall feedback was positive, it is interesting to examine some of the lowest ranked usability statements. The lowest ranked statement was statement 4 (I think I would need the help of a technical person to use this product). Bangor et al. (2008) claim this same statement has the lowest mean response, overall, and is also one of the statements that is sometimes removed because it is believed to be testing learnability, not usability (Lewis & Sauro, 2009). The other statement that is also considered learnability is Statement 10 (I could use the VR Classroom without having to learn anything new), another of the lowest ranked statements in my SUS results. Participants may have rated these learnability statements lower because they did not use the controller as part of the study. We checked the set up for them, and sometimes reloaded the home screen for them using the controller. As a result, they could have perceived this as a need for a technical person to be involved.

The low SUS responses to statements 5 (I found the various functions in the system were well integrated) and 6 (I thought there was a lot of consistency in the system) could be due to the confusing nature of the statements; however, the responses are also likely to be in response to some consistency issues: a video lag between the video and audio, flickering on the information panes, and inconsistent size, shape, colour and viewing angle with the viewing panes, shown in Figures 30 and 31.

Figure 30 - Information pane, showing inconsistent shape, size, colour and viewing angle

Figure 31 - Information pane showing inconsistent size and shape

The overall SUS score for female participants was 79.3 and the overall score for the male participants was 82. The one key difference between the data is the range of scores from the female participants who contributed the lowest score of 57.5 as well as the highest at 100. The lowest score was contributed by one of the first participants. In my research notes, I commented that they were very reserved and that the groups, in general, became more confident as the testing continued, a factor I attributed to the positive interactions with the students who returned to the classroom and shared what to expect. As the lowest score relates to one of the first users, it is possible that their nervousness affected their experience.

5.4.4 Testing Procedure

A number of issues were identified during the testing that could have affected the participants immersion into the VR Classroom. The testing was completed in the corridor, separated from the classroom by the teacher's office. It was out of sight of the other students and was a quiet space for testing. In order to get the testing completed in a 45 minute time frame, we tested the participants in pairs, but in future tests, I would suggest it is better to test them individually to prevent interaction between participants. There were also instances where assistants were talking to each other, or responding to questions from individual participants and this is also likely to have reduced the level of immersion.

It would be beneficial to have a video recording of the testing to time-sample the behaviours during the testing, as well as gain an accurate transcript of participant voice. I recorded anecdotal notes as I observed the tests, but my notes do not cover the full testing time because I was also helping to prepare the next pair of participants. Alongside the video recording, the development of gaze tracking for future testing would allow tracking of

participants' viewing patterns. Having a screen-capture of what a participant is viewing would also be useful to track viewing patterns.

Whilst the questionnaire provided a range of post testing data, it would be beneficial to have either a series of post-test interview questions or a focus group to attain participants' feedback. This would allow for questions to target specific features within the system and provide an opportunity to gain a greater understanding of the participants' experience.

5.4.5 VR Classroom Design Improvements

The development of the system has been an interesting process, and although it was developed to my specifications, the focus was mostly on getting all the aspects to work together. A focus of future iterations needs to go towards ensuring a smoother, more consistent experience across the different design elements. This would include ensuring the technical issues like video lagging and the information hotspot flickering are fixed. On top of this, the inclusion of a standard design for the information panels and the multi-choice questions should add consistency. Nevertheless, putting design concerns aside, the combined SUS score of 80.4 indicates that the system, as it stands, has strong learning potential.

The distraction created by the difference in height between the recording height of the video and the testing position on the swivel chair was an unexpected outcome, but something to explore further in future studies. The video height represents what the students commonly experience when receiving instructions in the classroom. The chairs could be adjusted according to student height so there is less variance in this area or, alternatively, I could record future iterations from a lower camera angle to simulate that of a seated participant. It is also recommended that the video is faded in over the still image, thereby reducing the surprise experienced when the teacher appears in the VR Classroom.

Other improvements to the classroom should include the addition of more videos, sound files, images, text information, and a wider range of quizzes. The development of a full system that allows each student to sign in and save data would allow for repeat use as well as tracking of completion and assessment data within the system. The capacity to add extra content and tasks for students to complete could also be beneficial to teachers, and ultimately a system could include a range of different subject. Another option to enhance the user experience is starting the video with a message that tells the user to have a look around the room, then pausing until the user starts the video again. This would allow participants time to visually scan each space within the VR Classroom before they need to focus on the given learning tasks.

The final area where the VR Classroom can be improved is through the addition of game elements. This could be through a stand-alone gamified VR Classroom, or as part of a full programme in which the VR Classroom is one of the elements of learning. This could require linking of the VR Classroom to other non-VR environments like Google Classroom ("Classroom: manage teaching and learning | Google for Education," n.d.). The addition of points, quests, badges and competition should effectively provide the vital element that is lost in the VR Classroom, the lack of a teacher who is monitoring what the students are doing. This being said, in a future system, the tutorials could be programmed to operate only when the participant is watching; if a student chooses to look around instead of focusing during the important video tutorials, the video can pause and a virtual teacher could say the participant's name and remind them to face back to the front, as if they were in a real classroom.

6 – Conclusion

6.1 Conclusion

My research question asks how immersive technologies can be used to enhance food-based education in New Zealand secondary schools. In this thesis, I have highlighted a number of examples of immersive technologies and their potential for this purpose but, in particular, I have created and evaluated a VR Classroom that uses a range of tools to teach food safety messages. The positive response to the system from students shows that there is potential to motivate students with this type of innovation. One hundred per cent of the participants strongly agreed that it was fun, wanted to have another go, and wanted to use similar technology in other subjects.

In the early stages of this thesis, I explored the issues surrounding the delivery of foods education. From the interviews and the case study, it became clear that students could benefit from a lot more compulsory practical cooking opportunities, with some classes in this study receiving as little as 13 hours of practical cooking lessons over two years. Teachers have very limited time in which to teach key food preparation skills and food safety. The use of a VR classroom as a flipped learning activity could provide an option for foods based teachers, enabling the learning to happen in a virtual world without the distractions usually present in a classroom. This could remove the need for much of the demonstration time from the classroom and allow more time for students to refine practical cooking skills.

As I worked through the process, it became clear that a virtual classroom, like the one used in this study, has a lot of potential to support inclusive education. Firstly it provides an opportunity for students who miss a demonstration, or important lesson, to effectively view the learning as if they were there. Alternatively, for students who did not fully understand the initial lesson, it provides an opportunity for them to revisit the lesson at another time. Students living, or attending school, in isolation could watch demonstrations and be part of a class, as if they were there, and then complete their practical learning in other parts of the country, or world. For students operating at different levels of the autism spectrum change can be stressful; the ability to complete lessons in a VR Classroom could allow them to become familiar with the new space and/or teacher before attending the class. With the number of schools currently being developed or rebuilt to include large open-plan classrooms for sometimes more than 100 students, it is a common concern that some students will struggle in these often noisier environments. The use of a VR Classroom could

provide a sanctuary for students that removes the noise and distractions, and allows them to focus on their learning.

Unlike a regular foods lesson, that relies on whole class demonstrations that may not suit all of the class as the same time, the learning in a VR Classroom can be guided by the students' needs. The students can choose which virtual lessons they attend, as they need them. I have deliberately not measured the learning associated with the VR Classroom when compared to the regular classroom however, indications from research show there is potential for a virtual classroom to be at least as effective as a regular classroom (Bodekaer, 2015; Jin & Nakayama, 2013).

The number of students distracted by the VR Classroom, who preferred to look around the virtual class instead of watching the tutorials, indicated there might need to be more interactivity. This was similar to when I evaluated the early iterations of the VR Classroom I noticed I was more interested in exploring the information popups than the passive viewing of the video. Alternative interactions could take the form of quizzes that pop up in the middle of videos to encourage learners to cognitively engage with the content, or a more gamified approach to the design that guides student learning through challenges and competition. Finding ways of combining some of the powerful online learning tools with the VR Classroom would be beneficial but, likewise, the VR Classroom could integrate with and complement other broader gamified programmes.

6.2 Future work

In a world where young people are constantly engaged with technology, we need to find ways to make learning more engaging. Gamification offers one avenue for this. Game elements have so much to offer education because of the intrinsic motivation (challenge and competition) and extrinsic motivation (badges or points) inherent within. A gamified VR Classroom that truly motivates students will provide not only a quality learning experience but also an enjoyment factor that encourages students to return for more.

While students were highly motivated by the VR Classroom in this study, the question remains, is it just the novelty of the VR that was motivating?. To test this, a study similar to that completed by Wang (2015) into the wear-out effect of Kahoot could be conducted to see if there is a wear-out effect with VR. Participants in two similar sample groups could be exposed to the VR Classroom in different ways. One group could spend 5-10 minutes in the VR Classroom every lesson while others might only use it a few times during the course.

This would provide an opportunity to see if the excitement over the use of VR wears off after repeated use.

Within the VR Classroom, I used 360 degree videos; it would be interesting to see a study exploring the effect of using 360 degree video tutorials with one that used standard video images within the virtual environment. Both options could prevent distractions as the video would still be the only thing showing, but the loss of presence in the classroom through moving to a standard video may reduce the overall experience for users.

I would like to see a study that explores the use of a VR Headset like the Oculus Go against a two dimensional screen like a computer to view the virtual classroom. There is likely to be a reduced sense of presence without the full visual immersion the VR headset provides, however, a computer would provide greater accessibility and functionality, for example in allowing note taking or with the capacity for multiple users to work together.

Another area that would be interesting to explore is the attention span of students in a virtual classroom. Gaze tracking could be used to monitor viewing patterns while students watch a variety of different length tutorial videos, to see if there is a switch-off time when they lose focus.

There is potential to develop a story based foods programme that uses the power of a mystery (or quest) to teach the key food safety messages. This could be along the lines of the story suggested earlier where the chef in the school canteen has just come down ill with food poisoning and the player needs to quickly bring the kitchen up to code before the inspector arrives. The player would need to clean, shop, and prepare and cook food in a time pressure situation. The addition of the story to the VR could provide further motivation to students and encourage repeat learning as they compete against the game and each other to solve the issues.

The VR Classroom has the potential to remove regular distractions from the classroom; things like the game of football that starts outside the classroom window, or students who are being noisy/disruptive can make learning difficult. Using a virtual classroom you can remove these distractions; however, it would be interesting to see at what point the distractions affect learning. How does adding other students into the virtual classroom affect a user's focus? Does it add to the realism? Does it increase the distraction? On top of this, it would be interesting to know if learning could be enhanced by having students in the video ask questions.

Regardless of the future research direction, 360 degree video and images provide exciting potential for today's educators and learners. The increasing ease with which a teacher can record high quality 360 degree content and distribute it for students to view and the enormous potential this virtual content has to engage learners will motivate teachers to embrace this technology.

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Appendices

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APPENDIX A – Interview Ethics Application

Low Risk Application Form

Ethical approval of low risk research involving human participants reviewed by departments or schools in the College of Education

PLEASE read the important notes appended to this form before completing the sections below

Researcher's Name:	Daniel Leo Gorman
Name of Department or School:	Human Interface (HIT Lab NZ)
Email Address:	daniel.gorman@pg.canterbury.ac.nz
Title of Project:	Using Immersive Technologies to Support Food Based Education
Projected Start Date of Project:	23rd July 2018
Staff member/supervisor responsible for project:	Bahareh Shahri, Robert Lindeman, Simon Hoermann
Names of other participating staff and students:	
Status of Research: (e.g. Thesis)	Master's Thesis
Brief description of the project: Please give a brief summary (approx. 300 words) of the nature of the proposal in lay language, including the aims/objectives/hypotheses of the project, rationale, participant description, and procedures/methods of the project:-	

In this project I am investigating the potential of Virtual Reality as a tool to teach students food-based, kitchen skills. My research question asks;

> *How can immersive technologies be used to enhance food-based education in New Zealand secondary schools?*

This first part of my study aims to identify what the most important skills students need to work in a school kitchen are, answering my sub-question

> *What are the most important skills students need in a food-based classroom?*

This overall research is a qualitative based exploratory study and this stage of the research involves interviewing a small sample of (4-6) specialist foods teachers, who currently teach, or have recently taught Year 7-10 foods classes. Interviews will continue until the emerging themes are saturated.

Firstly, I will start the interview by introducing my research and giving an explanation of Virtual Reality and the potential it has for education.

I will then ask the participants two questions;

1. What do you believe are the essential skills a student needs to have in order to work effectively in a secondary school foods programme?
2. How do you think virtual reality could be used to teach kitchen based skills?

The interviews will be transcribed, coded and analysed for similar elements. The result of this stage of the study will be a description of the skills required. The second question will add to my literature review and personal research into virtual reality as a way of identifying the most effective testing tool for later stages of my research.

Why is this a low risk application?

Description should include issues raised in the Low Risk Checklist (see below).
Please give details of any ethical issues which were identified during the consideration of the proposal and the way in which these issues were dealt with or resolved.

This part of the study is low risk because:
It involves non-invasive interviews that attempts to establish teachers perspectives on what skills are most useful for students to learn. All information gained in the interviews will be confidential to the author and my supervisors, and no participants or schools will be identified in any published work.

- **procedures for voluntary, informed consent**
  I will contact local intermediate and secondary school foods teachers with the information letter, seeking participants. Interviews will be arranged and participants will be given a copy of the consent form. At the interview I will reinforce the voluntary nature of the interview, the fact there will be no follow up that will identify the teacher and the teachers will be given time to complete the consent form. (The information letter and consent form are attached to this application.)
- **privacy & confidentiality**
  No information gathered will be named or used in isolation. Each participant will be given a number and this will be the only reference to them, if they are to be identified in future reporting. The teachers and their schools will not be identified.
- **how much anonymity can be offered and how it will be maintained**
  The teachers names or any identification of their school will not be used as part of the follow up work
- **risk to participants**
  There is no perceived risk to participants as all information will be confidential between the participant and the author and his supervisors, and there will be no reference to the participants or their school
- **obligations under the Treaty of Waitangi**
  Early discussions have identified a need for consultation on later stages of this research. However, for this initial stage we are not targeting any particular culture, will not be identifying any teachers involved in the study, and therefore, feel that we can safely proceed prior to, or concurrent with consultation.
- **needs of dependent persons**
  Not relevant to this study
- **conflict of interest**
  There are no known conflicts
- **permission for access to participants from other individuals or bodies**
  All participants are teachers and there is no need for consent from schools as the questions are not related to the school and no data gathered will identify the school or teachers.
- **inducements**
  There are no planned inducements for this part of the research.
- **dissemination of research findings**
  I will share the research findings with the participants in the form of the key findings.
- **storage and subsequent destruction of data**
  Recordings and transcriptions will be securely stored by the researcher and destroyed following the completion of the project.

Applicant's Name:	Daniel Gorman		
Signature:		Date:	5 July 2018

LOW RISK CHECKLIST – *PLEASE ALSO REFER TO THE NOTES AT THE BACK OF THIS DOCUMENT*

Please check that your application / summary has discussed:

- procedures for voluntary, informed consent
- privacy & confidentiality
- how much anonymity can be offered and how it will be maintained
- risk to participants
- obligations under the Treaty of Waitangi
- needs of dependent persons
- conflict of interest
- permission for access to participants from other individuals or bodies

- inducements
- dissemination of research findings
- storage and subsequent destruction of data

Please ensure that Sections A, B and C below are all completed

A SUPERVISOR DECLARATION:

1 I have made the applicant fully aware of the need for and requirement of seeking ERHEC approval for research involving human participants.
2 I have ensured the applicant is conversant with the procedures involved in making such an application.
3 The applicant has individually filled in this Low Risk application form which has been reviewed by me.

Signed (Supervisor):	Bahareh Shahri	Date:	July 3rd, 2018

B Supported by the Departmental/School Research Committee:

Name:		Signature:		Date:	

C Supported by the Head of Department/School:

Name:		Signature:		Date:	

Please attach copies of any Information Sheets, Consent Forms and/or Questionnaires as appropriate.
Forward **one hard copy and one electronic copy to**:

The Secretary
Educational Research Human Ethics Committee
Level 5 Matariki South (human-ethics@canterbury.ac.nz)

All queries will be forwarded to the applicant within 10 working days of receipt of the application by the Secretary of the committee.
Please include a copy of this form as an appendix in your thesis or course work

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Action taken by Educational Research Human Ethics Committee

☐	Added to Low Risk Reporting Database	☐	Referred to full ERHEC
☐	Referred to another Ethics Committee - Please specify:		
Approved by:		Date:	

NOTES CONCERNING LOW RISK APPLICATIONS

1. ***Procedures:***
   This **Low Risk** application form should **only be used** for proposals which are **Low Risk** as defined in the University of Canterbury Educational Research Human Ethics Committee Principles and Guidelines policy document.
   In consultation with the ERHEC, Departments or Schools will develop a process for review and approval. Departments or Schools will advise ERHEC if there are any subsequent changes to the process.
   The staff making application must sign a declaration that students:
   - undertaking those research projects are being made fully aware of the need for and the requirement of seeking ERHEC approval for all research involving human participants,
   - are conversant with the procedures involved in making such an application,
   - have individually filled in the required applications submitted to the concerned staff.

   A low risk notification form should be filled out and forwarded to the secretary of the ERHEC. Attachments should include a sample of the information and consent forms that will be used.
2. Low risk applications would involve the same risk as might be encountered in normal daily life. For example,
   a. Master's theses where the projects do not raise any issue of deception, threat, invasion of privacy, mental, physical or cultural risk or stress, and do not involve gathering personal information of a sensitive nature about or from individuals.
   b. Master's level supervised projects undertaken as part of specific course requirements where the projects do not raise any issue of deception, threat, invasion of privacy, mental, physical or cultural risk or stress, and do not involve gathering personal information of a sensitive nature about or from individuals.
   c. Undergraduate and Honours class research projects which do not raise any issue of deception, threat, invasion of privacy, mental, physical or cultural risk or stress, and do not involve gathering personal information of a sensitive nature about or from individuals, but do not have blanket approval as specified in Section 4 below.
3. No project, regardless of level, may be considered as low risk if it involves any of the following.:
   a. invasive physical procedures or potential for physical harm
   b. procedures which might cause mental/emotional stress or distress, moral or cultural offence
   c. personal or sensitive issues
   d. vulnerable groups
   e. Tangata Whenua
   f. cross cultural research
   g. investigation of illegal behaviour(s)
   h. invasion of privacy
   i. collection of information that might be disadvantageous to the participant
   j. use of information already collected that is not in the public arena which might be disadvantageous to the participant
   k. use of information already collected which was collected under agreement of confidentiality
   l. participants who are unable to give informed consent, including children
   m. conflict of interest e.g. the researcher is also the lecturer, teacher, treatment-provider, colleague or employer of the research participants, or there is any other power relationship between the researcher and the research participants
   n. deception
   o. audio or visual recording without consent
   p. withholding benefits from "control" groups
   q. inducements
   r. risks to the researcher

   The only exception to this is that research with children and young people in educational settings may be included in applications made within blanket approval category, *provided the skills and strategies being learned are those that would be expected to be part of normal teaching practice on completion of the qualification.*
   This list is not definitive but is intended to sensitise the researcher to the types of issues to be considered. Low risk research would involve the same risk as might be encountered in normal daily life.

In some circumstances research that appears to meet low risk criteria may need to be reviewed by the ERHEC. This might be because of requirements of:

- The publisher of the research
- An organisation which is providing funding resources, existing data, access to participant, etc.
- Research which meets the criteria for a review by a Health and Disability Ethics Committee (see HRC website).

4. A separate low risk form should be completed for each teaching or research proposal which involves human participants and for which ethical approval has been considered or given at Departmental or School level.
5. The completed form, **together copies of any Information Sheet or Consent Form**, should be returned to the Secretary, Educational Research Human Ethics Committee, Level 5 Matariki South, and by electronic copy, **as soon as the proposal has been considered at departmental or school level**.
6. The Information Sheet and Consent Form should NOT include the statement "This proposal has been reviewed and approved by the University of Canterbury Educational Research Human Ethics Committee" as this is inappropriate for low risk proposals. A statement such as "This proposal has been reviewed and approved by the Department/School of ….. University of Canterbury" must, however, be used.
7. Please ensure the Consent Form and the Information Sheet has been carefully proofread; the institution as a whole is likely to be judged by them.
8. ERHEC aims to notify applicants for low risk approval within ten working days of receiving the application from the Head of Department/School.
9. The research must be consistent with the UC ERHEC Principles and Guidelines. Refer to the appendices of the UC ERHEC Principles and Guidelines for guidance on information sheets and consent forms.
10. Please note that if the nature, procedures, location or personnel of the research project changes after departmental/school approval has been given in such a way that the research no longer meets the conditions laid out in Section 5 of the Principles and Guidelines, a full application to the ERHEC must be submitted.
11. Ensure that the reference is made to the ERHEC complaints procedure which should be included in the body of the information as follows: Complaints may be addressed to The Chair, Educational Research Human Ethics Committee, University of Canterbury, Private Bag 4800, Christchurch, Email: human-ethics@canterbury.ac.nz.
12. This form is available electronically at the following web address: http://www.canterbury.ac.nz/humanethics/erhec/apply.shtml
13. **Responsibility:**

    Supervisors are responsible for:

    a. Theses where the projects do not raise any issues listed.
    b. Masters level supervised projects undertaken as part of specific course requirements where the projects do not raise any issues listed.
    c. Undergraduate and Honours class research projects which do not raise any issues listed but do not have blanket approval as specified in the Principles and Guidelines.

    HODs are responsible for:

    a. Giving departmental or school approval in principle for the low risk application.
    b. Ensuring a copy of all applications is kept on file in the Department/School.
    c. Ensuring one hard copy and one electronic copy of the application are sent to the secretary of the ERHEC.
    d. Advising the applicant that the project may not commence before the Secretary of the ERHEC has advised final approval (see item 8 above).

The Educational Research Human Ethics Committee is happy to give advice on the appropriateness of research for low risk review.

Department: Human Interface Technology Laboratory
Telephone: +64 21 02271413

Email: daniel.gorman@pg.canterbury.ac.nz

2 July 2018

Using Immersive Technologies to Support Food Based Education

Information Sheet for Teachers

Dear Teachers,

My name is Daniel Gorman and I am a Masters' student at the University of Canterbury. I am conducting research into how Immersive technologies, (virtual reality, augmented reality and gaming) can be used in food-based education.

This study is being conducted under the supervision of Dr, Bahareh Shahri, Dr. Simon Hoermann and Prof. Robert Lindeman. You have been identified as a suitable participant due to your experience and role as a teacher of foods education.

The purpose of the interview is to establish the most important knowledge and skills students need to learn in a food-based classroom. I intend to make an audio recording of the interview so I can create an accurate transcript. It is estimated that the interview will take no more than 10 minutes of your time.

The interviews will be confidential to me and my research supervisors and I will not identify you or your school. The information gathered through this interview will be combined with that of other similar interviews and collated to establish the key learnings students need in food-based classrooms.

Participation is voluntary and you have the right to withdraw at any stage without penalty. You may ask for your raw data to be returned to you or destroyed at any point. If you withdraw, I will remove information relating to you. However, once analysis of raw data starts on the 1st of August, 2018, it will become increasingly difficult to remove the influence of your data on the results.

The results of this project will be published in my MHIT thesis and will be available through the University of Canterbury library. There may be further publications from this research however, you may be assured of the complete confidentiality of data gathered in this investigation: your identity will not be made public without your prior consent. To ensure anonymity and confidentiality, you will be given a participant number and this will be the only information that is used to identify you in the transcription and consequential reporting of data. No name or school references will be used. The data will be securely stored in a password protected folder on the HITLab server and will only be accessible by me or my supervisors. All data will be securely stored and destroyed after 5 years.

Please indicate to the researcher on the consent form if you would like to receive a copy of the summary of results of this project.

The project is being carried out as a requirement of the Master in Human Interface Technology degree by Daniel Gorman, under the supervision of Dr. Bahareh Shahri, who can be contacted at bahareh.shahri@canterbury.ac.nz. She will be pleased to discuss any concerns you may have about participation in the project.

This project has been reviewed and approved by the Human Interface Technology Laboratory at University of Canterbury. If you have any complaints please address them to The Chair, Educational Research Human Ethics Committee, University of Canterbury, Private Bag 4800, Christchurch, human-ethics@canterbury.ac.nz.

If you agree to participate in this study, you are asked to complete the consent form and return it to the researcher prior to starting your interview. Please email the completed consent form to daniel.gorman@pg.canterbury.ac.nz, or give to Daniel prior to the interview.

Daniel Gorman

Department: Human Interface Technology Laboratory
Telephone: +64 21 02271413
Email: daniel.gorman@pg.canterbury.ac.nz

Using Immersive Technologies to Support Food Based Education
Consent Form for Teachers

- ☐ I have been given a full explanation of this project and have had the opportunity to ask questions.
- ☐ I understand what is required of me if I agree to take part in the research.
- ☐ I understand that participation is voluntary and I may withdraw at any time without penalty. Withdrawal of participation will also include the withdrawal of any information I have provided should this remain practically achievable.
- ☐ I understand that any information or opinions I provide will be kept confidential to the researcher, Daniel Gorman and his supervisors, Bahareh Shahri, Simon Hoermann and Robert Lindeman and that any published or reported results will not identify the participants or their institutions. I understand that a thesis is a public document and will be available through the library of the University of Canterbury.
- ☐ I understand that all data collected for the study will be kept in locked and secure facilities and will be destroyed after five years.
- ☐ I understand that any audio recording media featuring my voice will not be shared with anyone beyond the researchers.
- ☐ I understand that I can contact the researcher, Daniel Gorman - daniel.gorman@pg.canterbury.ac.nz, or supervisor Dr. Bahareh Shahri - bahareh.shahri@canterbury.ac.nz, for further information. If I have any complaints, I can contact the Chair of the University of Canterbury Educational Research Human Ethics Committee, Private Bag 4800, Christchurch - human-ethics@canterbury.ac.nz
- ☐ I would like a summary of the results of the project.
- ☐ By signing below, I agree to participate in this research project.

Name: _____ Signed: _____ Date: _____

Email address *(for report of findings, if indicated above)*: _____

Please return this Consent Form to Daniel (the researcher) via hard copy in-person or e-mail to daniel.gorman@pg.canterbury.ac.nz.

APPENDIX B – Interview Approval

UNIVERSITY OF CANTERBURY
Te Whare Wānanga o Waitaha
CHRIST CHURCH NEW ZEALAND

HUMAN ETHICS COMMITTEE

Secretary, Rebecca Robinson
Telephone: +64 03 369 4588, Extn 94588
Email: human-ethics@canterbury.ac.nz

Ref: 2018/05/ERHEC-LR

23 July 2018

Daniel Leo Gorman
HIT Lab NZ
UNIVERSITY OF CANTERBURY

Dear Daniel

Thank you for submitting your low risk application to the Educational Research Human Ethics Committee for your research proposal titled "Using Immersive Technologies to Support Food Based Education".

I am pleased to advise that this application has been reviewed and I confirm support of the School's approval for this project.

With best wishes for your project.

Yours sincerely

pp R. Robinson

Dr Patrick Shepherd
Chair
Educational Research Human Ethics Committee

Please note that ethical approval relates only to the ethical elements of the relationship between the researcher, research participants and other stakeholders. The granting of approval by the Educational Research Human Ethics Committee should not be interpreted as comment on the methodology, legality, value or any other matters relating to this research.

F E S

APPENDIX C – Māori Consultation

Date:30 September 2018	College/Department **Engineering -** Human Interface Technology
Principal Investigator: Daniel Gorman **Associate Investigators:** Bahareh Shahri, Simon Hoermann, Rob Lindeman **Cultural Advisors, if any:** **Please note if you have sought advice from NTRC, or other mana whenua representatives:** No	
Project Title: Using Immersive Technologies to Support Food Based Education	

Concise description in lay terms of the proposed project, including brief methodology (up to 1 page):

My project involves looking at current foods education delivery in New Zealand and then exploring ways that immersive technologies including games, virtual reality or augmented reality could be used to enhance the programmes.

In order to do this, there are three parts to the study. In the first part of the study I interviewed four specialist foods teachers, in local intermediate and junior secondary settings, who have shared the key skills, they believe, students need to learn as well as the current teaching strategies they use to teach these skills.

The second part of the study involves me completing a case study of a local school setting, spending approximately a week exploring how this school approaches teaching and learning. I anticipate spending the majority of my time shadowing the two foods teachers, with a focus on the Years 9-10 level. However, the study will also explore the impact of the Year 7 and 8 programmes prior to secondary as well as considering programmes in the senior school (Years 11-13). During this time I will spend time observing, but where appropriate, I will involve myself in the class by either participating in the lesson or assisting. On top of this I hope to run a focus group with the technology department and a student focus group interview.

This case study will be used to reinforce the results of my interviews that focused on the sub question, "what are the most important skills students need in a food-based classroom?" It will also allow me to answer my second research sub-question, what interventions would be appropriate for this particular school?

I have been given permission to work at Middleton Grange School for this stage of my study, where I will be working with the Year 7-10 foods teacher for the bulk of my time.

In the third stage of my study I will take an intervention that may include a game, virtual reality or augmented reality back to Middleton Grange School to trial with a group of students. This stage will involve me exploring the effects of the intervention on the students in forms of motivation and interest.

No students will be identified in any published part of my study.

Does the proposed research involve any of the following? Please underline.

- *Significant Māori content*
- *Access to Māori sites*
- *Sampling of native flora/fauna*
- *Culturally sensitive material/knowledge*
- *Māori involvement as participants or subjects*
- *Research where Māori data is sought and analysed*
- *Research that will impact on Māori*

If you have underlined any of the above, please explain in more detail:

Whilst my study may not include any students who are Māori, I am likely to come across Māori students through the course of my study. Approximately 7% of the Middleton Grange roll are Māori, meaning that in any given class there is likely to be two or more Māori students. On top of this there is a chance that I will be interacting with teachers who are Māori and I need to be conscious of this throughout my time in the school.

Throughout my time at Middleton Grange School I will be conscious of the teachings of Tataiako (Education Council of Aotearoa New Zealand (2011), especially in regards to:

- **"Whanaungatanga:** actively engaging in respectful working relationships with Māori learners, parents and whānau, hapū, iwi and the Māori community.
- **Manaakitanga:** showing integrity, sincerity and respect towards Māori beliefs, language and culture" (p.4).

The concept of Manaakitanga is further expanded by (Berryman & Lamont, 2013) who claim "Effective teachers of Māori students demonstrate, on a daily basis, that they care for the students as culturally located human beings above all else" (p.3).

(Bishop & Berryman (2009) explain that in order to teach or interact with Māori students you need to ensure you develop a positive, respectful relationship, one where you are a part of their learning story not the only voice.

Whilst my role is limited within the school I intend to make myself as positive, open and non-judgemental as possible. Specifically I will use my mihi to introduce myself to classes allowing the students to know more about me (Tataiako, p.5). I will also mix my greetings between Māori and English and if I know or feel a student or staff member may be Māori I will tend towards tena koe, or kia ora. In the focus group I will make time for each student to introduce themselves including seeking information about their family and out of school activities.

In the general classroom I will not be identifying the culture of any particular students, but in the focus group I will aim to have at least one participant who identifies themselves as Māori as this will hopefully add a cultural context and more depth when I begin the planning of my intervention for the third stage of the project. I will ask the school to help me select the group of students for this stage of the study.

Whanau will be informed of my study through a general letter, or through the school newsletter outlining the purpose of my study, a brief bio, and where I may be involved within the school. Students involved in my focus group will be given a detailed letter outlining the purpose of my study and parental and student permission will be attained prior to the focus group.

Bibliography

Berryman, M., & Lamont, R. (2013). The effective teaching profile: Activities and resources.

Bishop, R., & Berryman, M. (2009). The Te kotahitanga effective teaching profile. *Set: Research Information for Teachers (Wellington)*, (2), 27. Retrieved from https://ezp.lib.unimelb.edu.au

Burdea, G. C. (n.d.). *Haptic Feedback for Virtual Reality 1*. Retrieved from http://www.caip.rutgers.edu/vrlab

Education Council of Aotearoa New Zealand. (2011). Cultural competencies for teachers of Māori learners: Tātaiako.

Lichtman, M. (2011). *Understanding and evaluating qualitative educational research*. SAGE.

APPENDIX D – Māori Consultation Approval

Ngāi Tahu Consultation and Engagement Group

Monday 8 October 2018

Tēnā koe Daniel Gorman

RE: Using Immersive Technologies to Support Food Based Education

This letter is on behalf of the Ngāi Tahu Consultation and Engagement Group (NTCEG). I have considered your proposal and acknowledge it is a worthwhile and interesting project and you are clear about how you ought to take participants' (cultural) needs into account if and when applicable.

Given the scope of your project, no issues have been identified and further consultation with Māori is not required.

Thank you for engaging with the Māori consultation process. This will strengthen your research proposal, support the University's Strategy for Māori Development, and increase the likelihood of success with external engagement. It will also increase the likelihood that the outcomes of your research will be of benefit to Māori communities. We wish you all the best with your current project and look forward to hearing about future research plans.

The Ngāi Tahu Consultation and Engagement Group would appreciate a summary of your findings on completion of the current project. Please feel free to contact me if you have any questions.

Ngā mihi whakawhetai ki a koe

Henrietta Carroll (on behalf of the NTCEG)

Kaiarāhi Maori Research
Research & Innovation | Te Rōpū Rangahau
University of Canterbury | Te Whare Wānanga o Waitaha
Phone +64 3 369 0143, Private Bag 4800, Christchurch | Ōtautahi
henrietta.latimer@canterbury.ac.nz
http://www.research.canterbury.ac.nz

APPENDIX E – Case Study Ethics Application

Low Risk Application Form

Ethical approval of low risk research involving human participants reviewed by departments or schools in the College of Education

PLEASE read the important notes appended to this form before completing the sections below

Researcher's Name:	Daniel Leo Gorman
Name of Department or School:	Human Interface Technology Lab (HIT Lab NZ)
Email Address:	daniel.gorman@pg.canterbury.ac.nz
Title of Project:	Using Immersive Technologies to Support Food Based Education
Projected Start Date of Project:	22nd October 2018
Staff member/supervisor responsible for project:	Bahareh Shahri, Robert Lindeman, Simon Hoermann
Names of other participating staff and students:	
Status of Research: (e.g. Thesis)	Master's Thesis

Brief description of the project:

Please give a brief summary (approx. 300 words) of the nature of the proposal in lay language, including the aims/objectives/hypotheses of the project, rationale, participant description, and procedures/methods of the project:-

In this project I am investigating the potential of immersive technologies, like virtual reality, as a way to teach students food-based, kitchen skills. My research question asks; "How can immersive technologies be used to enhance food-based education in New Zealand secondary schools?" The overall research is a qualitative based exploratory study that includes Stage 1, a series of teacher interviews exploring the necessary skills and attributes students need and the pedagogical approaches used to teach these skills / attributes. My Low Risk Application for Stage 1 was reviewed and approved on the on 23rd July 2018. (Ref. 2018/05/ERHEC-LR)

The second part of my research, which this application pertains to, will be a case study of learning at Middleton Grange School. This will allow me to answer my second sub-question "What interventions would be appropriate for this particular school?" The case study will also allow me to reinforce the learnings from stage 1 of my study, where I have explored "the most important skills students need in a food-based classroom?" (Research sub-question 1)

I have been given permission by Middleton Grange School to complete this stage of my research at their school and I expect this will involve one to two weeks working within the school. During this time I will complete a range of research elements that make up the overall case study, including: looking through school documentation, observing foods classes, talking with staff, a focus group with teachers and a focus group with students from the Year 7-10 level of the school. I will be hosted by the Year 7-10 Foods teacher but will also spend time with the senior secondary foods teacher and potentially other teachers within the technology and foods departments. Where possible I intend to take on a "participant observer" role as described by Lichtman (2011). In this way I will involve myself in what is happening in the classroom rather than just being a passive observer.

The information gained in this case study combined with the learnings from the previous interviews will influence the design of my intervention, planned to be evaluated with students at Middleton Grange School in Stage 3 of my study.

Why is this a low risk application?

Description should include issues raised in the Low Risk Checklist (see below).
Please give details of any ethical issues which were identified during the consideration of the proposal and the way in which these issues were dealt with or resolved.

This part of the study is low risk because:

It involves a range of non-invasive methods that will attempt to define the learning culture at Middleton Grange School with a focus on trying to match the current students, staff and culture with a potential intervention for the next phase of my study. All information gained will be confidential to me and my supervisors, and no participants will be identified in any published work. I am an experienced teacher and leader and this research is similar to what a practising teacher would undergo as a regular part of school life.

- **procedures for voluntary, informed consent**

  Initially I approached four local secondary schools to seek permission to work within the school for stage 2 & 3 of my study. After some promising leads with two of the schools Middleton Grange has given verbal confirmation that they are happy to host me for the next steps in my study.

  The key consent required will be the school, the specific teachers involved in observations and the teachers and students in the focus groups. In each case an information sheet will be provided and suitable time allowed to consider before consent is confirmed. At the commencement of the focus groups and classroom observations it will be made clear that it is voluntary and they can withdraw from the study then or at any stage following.

  Below I have listed six key consent processes that I have considered as part of this research. Each of these areas is outlined in more detail through the letters and forms, attached to the end of this application.

  1. A formal letter will be sent to the Principal with details about my study seeking formal confirmation prior to commencement.
  2. A brief biography and project outline for parents, that I anticipate the principal will place in the school newsletter detailing who I am and the purpose of my study.
  3. The teachers who I observe will be given a letter and permission slip prior to me working in their classroom.
  4. The teachers involved in the focus group will be given information sheets and permission slips to complete prior to the meeting
  5. The students involved in the student focus group and their parents will be given information sheets and permission slips to complete prior to the meeting. To select the students I will ask the school to provide me with a list of students and select them numerically, to get a cohort of up to 8 students.

- **privacy & confidentiality**

No information gathered will be named or used in isolation. Each participant will be given a number and this will be the only reference to them if any in future reporting. The teachers will not be identified by name and the nature of the study does not require that I identify individuals however, as I am focused on a specific area within the school It may be possible for teachers to be identified within the thesis. As I am looking to construct a picture of the school as a whole as an author I will take care no written aspects of this thesis identifies participants in a way that could be harmful.

- **how much anonymity can be offered and how it will be maintained**
- The teachers names will not be used as part of the follow up work however, they may be able to be identified through the identification of their school. The students will not be identifiable as they will be referenced by their student number for example, "Student 1". The teachers may be identifiable but as an author it is my role to ensure the writing protects their anonymity.
- **risk to participants**

  A key potential risk is me working with junior secondary school and intermediate aged students. As a fully registered and experienced teacher I understand school etiquette and am focused on safe interactions between teacher and student. The research being undertaken, in stage two, is very similar to the appraisal observations and technology centre reviews I have completed over the last 8 years as a part of my leadership roles.

  All information will be confidential between the participant, the author and his supervisors, and there will be no reference to the participants by name in any written reporting as part of this thesis.
- **obligations under the Treaty of Waitangi**

  A Māori consultation form has been completed and approved, see copied letter of approval from Henrietta Carroll (on behalf of the NTCEG), at the end of this application.

  The reasons for the consultation are that the research will involve observations in classrooms, and involve potential interactions with students and teachers who are Māori. My goal is to make them feel as comfortable working with me as possible, giving me a greater chance of hearing their unique perspectives. The overall student roll at Middleton Grange School includes approximately 7% students identified as Māori. It is my intention to try and have at least one student from this cohort as part of my student focus group and I will ask staff at Middleton Grange School to help me with selection of this participant.
- **needs of dependent persons**

  Not relevant to this study
- **conflict of interest**

  There are no known conflicts
- **permission for access to participants from other individuals or bodies**

  Permissions for the project will be sought as discussed in the procedures for voluntary consent above. This involves permission from the school through the principal and permission from parents for the students to be involved in the focus groups.

  It is planned that members of the teacher focus groups will receive a $20 voucher as an inducement. It is planned that students involved in the focus group would receive a $10 voucher as an inducement. However, if the students are released to attend the focus group during class time there would be no inducement.
- **dissemination of research findings**

  I will share the research findings with the participants in the form of the key findings.
- **storage and subsequent destruction of data**

  Recordings and transcriptions will be securely stored by the researcher and destroyed following the completion of the project.

Applicant's Name:	Daniel Gorman		
Signature:	Daniel Leo Gorman	Date:	8 October 2018

LOW RISK CHECKLIST – *PLEASE ALSO REFER TO THE NOTES AT THE BACK OF THIS DOCUMENT*

Please check that your application / summary has discussed:

- procedures for voluntary, informed consent
- privacy & confidentiality
- how much anonymity can be offered and how it will be maintained
- risk to participants
- obligations under the Treaty of Waitangi
- needs of dependent persons
- conflict of interest
- permission for access to participants from other individuals or bodies
- inducements
- dissemination of research findings
- storage and subsequent destruction of data

Please ensure that Sections A, B and C below are all completed

A SUPERVISOR DECLARATION:

4 I have made the applicant fully aware of the need for and requirement of seeking ERHEC approval for research involving human participants.
5 I have ensured the applicant is conversant with the procedures involved in making such an application.
6 The applicant has individually filled in this Low Risk application form which has been reviewed by me.

Signed (Supervisor):	Bahareh J. Shahri	Date:	08/10/18

B Supported by the Departmental/School Research Committee:

Name:		Signature:		Date:	

C Supported by the Head of Department/School:

Name:	Rob Lindeman	Signature:	Robert Lindeman	Date:	2018-10-09

Please attach copies of any Information Sheets, Consent Forms and/or Questionnaires as appropriate.
Forward **one hard copy and one electronic copy to**:

The Secretary
Educational Research Human Ethics Committee
Level 5 Matariki South (human-ethics@canterbury.ac.nz)

All queries will be forwarded to the applicant within 10 working days of receipt of the application by the Secretary of the committee.
Please include a copy of this form as an appendix in your thesis or course work

---

Action taken by Educational Research Human Ethics Committee

☐	Added to Low Risk Reporting Database	☐	Referred to full ERHEC
☐	Referred to another Ethics Committee - Please specify:		
Approved by:		Date:	

NOTES CONCERNING LOW RISK APPLICATIONS

1. ***Procedures:***

   This **Low Risk** application form should **only be used** for proposals which are **Low Risk** as defined in the University of Canterbury Educational Research Human Ethics Committee Principles and Guidelines policy document.

   In consultation with the ERHEC, Departments or Schools will develop a process for review and approval. Departments or Schools will advise ERHEC if there are any subsequent changes to the process.

   The staff making application must sign a declaration that students:

   - undertaking those research projects are being made fully aware of the need for and the requirement of seeking ERHEC approval for all research involving human participants,
   - are conversant with the procedures involved in making such an application,
   - have individually filled in the required applications submitted to the concerned staff.

   A low risk notification form should be filled out and forwarded to the secretary of the ERHEC. Attachments should include a sample of the information and consent forms that will be used.

5. Low risk applications would involve the same risk as might be encountered in normal daily life. For example,

   d. Master's theses where the projects do not raise any issue of deception, threat, invasion of privacy, mental, physical or cultural risk or stress, and do not involve gathering personal information of a sensitive nature about or from individuals.

   e. Master's level supervised projects undertaken as part of specific course requirements where the projects do not raise any issue of deception, threat, invasion of privacy, mental, physical or cultural risk or stress, and do not involve gathering personal information of a sensitive nature about or from individuals.

   f. Undergraduate and Honours class research projects which do not raise any issue of deception, threat, invasion of privacy, mental, physical or cultural risk or stress, and do not involve gathering personal information of a sensitive nature about or from individuals, but do not have blanket approval as specified in Section 4 below.

6. No project, regardless of level, may be considered as low risk if it involves any of the following.:
   a. invasive physical procedures or potential for physical harm
   b. procedures which might cause mental/emotional stress or distress, moral or cultural offence
   c. personal or sensitive issues
   d. vulnerable groups
   e. Tangata Whenua
   f. cross cultural research
   g. investigation of illegal behaviour(s)
   h. invasion of privacy
   i. collection of information that might be disadvantageous to the participant
   j. use of information already collected that is not in the public arena which might be disadvantageous to the participant
   k. use of information already collected which was collected under agreement of confidentiality
   l. participants who are unable to give informed consent, including children
   m. conflict of interest e.g. the researcher is also the lecturer, teacher, treatment-provider, colleague or employer of the research participants, or there is any other power relationship between the researcher and the research participants
   n. deception
   o. audio or visual recording without consent
   p. withholding benefits from "control" groups
   q. inducements
   r. risks to the researcher

   The only exception to this is that research with children and young people in educational settings may be included in applications made within blanket approval category, *provided the skills and strategies being learned are those that would be expected to be part of normal teaching practice on completion of the qualification.*

This list is not definitive but is intended to sensitise the researcher to the types of issues to be considered. Low risk research would involve the same risk as might be encountered in normal daily life.

In some circumstances research that appears to meet low risk criteria may need to be reviewed by the ERHEC. This might be because of requirements of:

- The publisher of the research
- An organisation which is providing funding resources, existing data, access to participant, etc.
- Research which meets the criteria for a review by a Health and Disability Ethics Committee (see HRC website).

7. A separate low risk form should be completed for each teaching or research proposal which involves human participants and for which ethical approval has been considered or given at Departmental or School level.
5. The completed form, **together copies of any Information Sheet or Consent Form**, should be returned to the Secretary, Educational Research Human Ethics Committee, Level 5 Matariki South, and by electronic copy, **as soon as the proposal has been considered at departmental or school level**.
6. The Information Sheet and Consent Form should NOT include the statement "This proposal has been reviewed and approved by the University of Canterbury Educational Research Human Ethics Committee" as this is inappropriate for low risk proposals. A statement such as "This proposal has been reviewed and approved by the Department/School of ….. University of Canterbury" must, however, be used.
7. Please ensure the Consent Form and the Information Sheet has been carefully proofread; the institution as a whole is likely to be judged by them.
8. ERHEC aims to notify applicants for low risk approval within ten working days of receiving the application from the Head of Department/School.
9. The research must be consistent with the UC ERHEC Principles and Guidelines. Refer to the appendices of the UC ERHEC Principles and Guidelines for guidance on information sheets and consent forms.
10. Please note that if the nature, procedures, location or personnel of the research project changes after departmental/school approval has been given in such a way that the research no longer meets the conditions laid out in Section 5 of the Principles and Guidelines, a full application to the ERHEC must be submitted.
14. Ensure that the reference is made to the ERHEC complaints procedure which should be included in the body of the information as follows: Complaints may be addressed to The Chair, Educational Research Human Ethics Committee, University of Canterbury, Private Bag 4800, Christchurch, Email: human-ethics@canterbury.ac.nz.
15. This form is available electronically at the following web address: http://www.canterbury.ac.nz/humanethics/erhec/apply.shtml
16. **Responsibility:**

    Supervisors are responsible for:

    a. Theses where the projects do not raise any issues listed.
    b. Masters level supervised projects undertaken as part of specific course requirements where the projects do not raise any issues listed.
    c. Undergraduate and Honours class research projects which do not raise any issues listed but do not have blanket approval as specified in the Principles and Guidelines.

    HODs are responsible for:

    e. Giving departmental or school approval in principle for the low risk application.
    f. Ensuring a copy of all applications is kept on file in the Department/School.
    g. Ensuring one hard copy and one electronic copy of the application are sent to the secretary of the ERHEC.
    h. Advising the applicant that the project may not commence before the Secretary of the ERHEC has advised final approval (see item 8 above).

The Educational Research Human Ethics Committee is happy to give advice on the appropriateness of research for low risk review.

Principal Information Sheet

Department: Human Interface Technology Laboratory
Telephone: +64 21 02271413

Email: daniel.gorman@pg.canterbury.ac.nz

8 October 2018

Using Immersive Technologies to Support Food Based Education
Information Sheet for Principal

Dear Richard,

My name is Daniel Gorman and I am a Masters' student at the University of Canterbury. I am conducting research into how Immersive technologies like virtual reality, augmented reality and gaming can be used in food-based education. This study is being conducted under the supervision of Dr, Bahareh Shahri, Dr. Simon Hoermann and Prof. Robert Lindeman.

I would like to complete research at your school for 1-2 weeks while I complete a case study with a particular focus on the foods areas. As part of this study I anticipate using a range of research methods including looking at school documentation, classroom observations, and a teacher and a student focus group. A few weeks after the case study period I would like to return with a potential intervention, likely a game or a piece of virtual reality software, and see how the students interact with it.

The purpose of the case study is to answer my second research sub-question "What interventions would be appropriate for this particular school?" This is the second stage of three in my study, attempting to answer my overall research question;

> *How can immersive technologies be used to enhance food-based education in New Zealand secondary schools?*

In the first part of my study I interviewed specialist foods teachers to explore what they considered the key skills and attributes a student needed to thrive in food-based classrooms. Following on from this I want to further explore the foods context at Middleton Grange School as I attempt to understand what sort of intervention would best suit your students.

All information gained through this study will be confidential to me and my supervisors and no participants will be identified in further publications that come from this study. The information gathered will be collated, and analysed to establish the key findings.

Participation is voluntary and you have the right to withdraw at any stage without penalty. You may ask for your raw data to be returned to you or destroyed at any point. If you withdraw, I will remove any information relating to you and Middleton Grange School from my research.

The results of this project will be published in my MHIT thesis and will be available through the University of Canterbury library. There may be further publications from this research however, you may be assured of the complete confidentiality of data gathered in this investigation: your identity and that of your staff and students will not be made public without your prior consent. To ensure anonymity and confidentiality, each participant will be given a participant number and this will be the only information that is used to identify them in the transcription and consequential reporting of data. The data will be securely stored in a password protected folder on the HIT Lab server and will only be accessible by me or my supervisors. All data will be destroyed after 5 years.

Please indicate on the consent form if you would like to receive a copy of the summary of results of this project.

The project is being carried out as a requirement of the Master in Human Interface Technology degree by Daniel Gorman, under the supervision of Dr. Bahareh Shahri, who can be contacted at bahareh.shahri@canterbury.ac.nz. She will be pleased to discuss any concerns you may have about participation in the project.

This project has been reviewed and approved by the Human Interface Technology Laboratory at University of Canterbury. If you have any complaints please address them to The Chair, Educational Research Human Ethics Committee, University of Canterbury, Private Bag 4800, Christchurch, human-ethics@canterbury.ac.nz.

If you agree to participate in this study, you are asked to complete the consent form and return it to Daniel in person or by email to daniel.gorman@pg.canterbury.ac.nz.

Daniel Gorman

Principal Consent Form

Department: Human Interface Technology Laboratory
Telephone: +64 21 02271413
Email: daniel.gorman@pg.canterbury.ac.nz

Using Immersive Technologies to Support Food Based Education
Consent Form for Teachers

- ☐ I have been given a full explanation of this project and have had the opportunity to ask questions.
- ☐ I understand what is required of me if I agree to take part in the research.
- ☐ I understand that participation is voluntary and I may withdraw my support for this research at any time without penalty. Withdrawal of participation will also include the withdrawal of any information pertaining to Middleton Grange School, should this remain practically achievable.
- ☐ I understand that any information or opinions I provide will be kept confidential to the researcher, Daniel Gorman and his supervisors, Bahareh Shahri, Simon Hoermann and Robert Lindeman and that any published or reported results will not identify the participants. I understand that a thesis is a public document and will be available through the library of the University of Canterbury.
- ☐ I understand that all data collected for the study will be kept in locked and secure facilities and will be destroyed after five years.
- ☐ I understand that any audio recording media featuring my voice or that of my staff or students will not be shared with anyone beyond the researchers.
- ☐ I understand that I can contact the researcher, Daniel Gorman - daniel.gorman@pg.canterbury.ac.nz, or supervisor Dr. Bahareh Shahri - bahareh.shahri@canterbury.ac.nz, for further information. If I have any complaints, I can contact the Chair of the University of Canterbury Educational Research Human Ethics Committee, Private Bag 4800, Christchurch - human-ethics@canterbury.ac.nz
- ☐ I would like a summary of the results of the project.
- ☐ By signing below, I agree to participate in this research project.

Name: _____ Signed: _____ Date: _____

Email address *(for report of findings, if indicated above)*: _____

Please return this Consent Form to Daniel (the researcher) via hard copy in-person or e-mail to daniel.gorman@pg.canterbury.ac.nz.

Bio and Information sheet for sharing with parents

This can be adapted by the Principal as necessary.

Kia ora,

My name is Daniel Gorman and I will be completing some research at Middleton Grange School over the next few weeks and will likely be seen in a number of classes, especially in the technology and foods area. I am currently a Masters' student at the University of Canterbury where I am studying towards a Master of Human Interface Technology degree. I am an experienced teacher who up until this year was the Technology Centre Manager at Te Waka Unua School.

My research is exploring how Immersive Technologies, like virtual reality or gaming, can be used to enhance food-based education. The goal for this stage of my research is to explore how students learn at Middleton Grange, as I look to develop an intervention, like a game or virtual reality activity that I hope to test later in the year.

Please rest assured that all information gained through this research is confidential to me and my research supervisors and I will not be taking any photos of your children or using any names or individual details.

If you have any questions you can email me on daniel.gorman@pg.canterbury.ac.nz.

This project has been reviewed and approved by the Human Interface Technology Laboratory at University of Canterbury. If you have any complaints please address them to The Chair, Educational Research Human Ethics Committee, University of Canterbury, Private Bag 4800, Christchurch, human-ethics@canterbury.ac.nz.

Nga mihi nui

Daniel

Classroom Observation Information Sheet (Teachers)

Department: Human Interface Technology Laboratory
Telephone: +64 21 02271413

Email: daniel.gorman@pg.canterbury.ac.nz

8 October 2018

Using Immersive Technologies to Support Food Based Education
Information Sheet for Teachers

Dear Teachers,

My name is Daniel Gorman and I am a Masters' student at the University of Canterbury. I am conducting research into how Immersive technologies, (virtual reality, augmented reality and gaming) can be used in food-based education.

This study is being conducted under the supervision of Dr, Bahareh Shahri, Dr. Simon Hoermann and Prof. Robert Lindeman.

The purpose of the observations is to explore how learning happens at Middleton Grange School so I can develop a suitable intervention, like a game or virtual reality activity, which will suit the students at your school. The observations are only related to my thesis study and are confidential to me and my research supervisors. It will be combined with the other data gathered during my time at your school and collated to establish the key findings of this stage of my study.

Participation is voluntary and you have the right to withdraw at any stage without penalty. You may ask for your raw data to be returned to you or destroyed at any point. If you withdraw, I will remove information relating to you. However, once analysis of raw data starts on the 1st November, 2018, it will become increasingly difficult to remove the influence of your data on the results.

The results of this project will be published in my MHIT thesis and will be available through the University of Canterbury library. There may be further publications from this research however, you may be assured of the complete confidentiality of data gathered in this investigation: your identity will not be made public without your prior consent. To ensure anonymity and confidentiality, you will be given a participant number and this will be the only information that is used to identify you in the transcription and consequential reporting of data. No names will be used. The data will be securely stored in a password protected folder on the HIT Lab server and will only be accessible by me or my supervisors. All data will be securely stored and destroyed after 5 years.

Please indicate to the researcher on the consent form if you would like to receive a copy of the summary of results of this project.

The project is being carried out as a requirement of the Master in Human Interface Technology degree by Daniel Gorman, under the supervision of Dr. Bahareh Shahri, who can be contacted at bahareh.shahri@canterbury.ac.nz. She will be pleased to discuss any concerns you may have about participation in the project.

This project has been reviewed and approved by the Human Interface Technology Laboratory at University of Canterbury. If you have any complaints please address them to The Chair, Educational Research Human Ethics Committee, University of Canterbury, Private Bag 4800, Christchurch, human-ethics@canterbury.ac.nz.

If you agree to participate in this study, you are asked to complete the consent form and return it to the researcher prior to the observation. Please email the completed consent form to daniel.gorman@pg.canterbury.ac.nz, or give to Daniel prior to the observation.

Daniel Gorman

Department: Human Interface Technology Laboratory
Telephone: +64 21 02271413

Email: daniel.gorman@pg.canterbury.ac.nz

Using Immersive Technologies to Support Food Based Education
Consent Form for Teachers

- ☐ I have been given a full explanation of this project and have had the opportunity to ask questions.
- ☐ I understand what is required of me if I agree to take part in the research.
- ☐ I understand that participation is voluntary and I may withdraw at any time without penalty. Withdrawal of participation will also include the withdrawal of any information I have provided should this remain practically achievable.
- ☐ I understand that any information or opinions I provide will be kept confidential to the researcher, Daniel Gorman and his supervisors, Bahareh Shahri, Simon Hoermann and Robert Lindeman and that any published or reported results will not identify the participants. I understand that a thesis is a public document and will be available through the library of the University of Canterbury.
- ☐ I understand that all data collected for the study will be kept in locked and secure facilities and will be destroyed after five years.
- ☐ I understand that I can contact the researcher, Daniel Gorman - daniel.gorman@pg.canterbury.ac.nz, or supervisor Dr. Bahareh Shahri - bahareh.shahri@canterbury.ac.nz, for further information. If I have any complaints, I can contact the Chair of the University of Canterbury Educational Research Human Ethics Committee, Private Bag 4800, Christchurch - human-ethics@canterbury.ac.nz
- ☐ I would like a summary of the results of the project.
- ☐ By signing below, I agree to participate in this research project.

Name: _____ Signed: _____ Date: _____

Email address *(for report of findings, if indicated above)*: _____

Please return this Consent Form to Daniel (the researcher) via hard copy in-person or e-mail to daniel.gorman@pg.canterbury.ac.nz.

Department: Human Interface Technology Laboratory
Telephone: +64 21 02271413
Email: daniel.gorman@pg.canterbury.ac.nz

8 October 2018

Using Immersive Technologies to Support Food Based Education
Information Sheet for Teachers

Dear Teachers,

My name is Daniel Gorman and I am a Masters' student at the University of Canterbury. I am conducting research into how Immersive technologies, (virtual reality, augmented reality and gaming) can be used in food-based education.

This study is being conducted under the supervision of Dr, Bahareh Shahri, Dr, Simon Hoermann and Prof, Robert Lindeman.

The purpose of the focus group is to understand the learning context of Middleton Grange School so I can develop an intervention (likely a game or virtual reality experience) that has the most likelihood of success in Stage 3 of my study. I intend to make an audio recording of the focus group so that I can create an accurate transcript. It is estimated that the focus group will take approximately 45 minutes to complete.

The focus group will be confidential to me and my research supervisors and any information gathered through this interview will be combined, with other data gained during my time at your school, and collated to define the key findings for this stage of my research.

Participation is voluntary and you have the right to withdraw at any stage without penalty. You may ask for your raw data to be returned to you or destroyed at any point. If you withdraw, I will remove information relating to you. However, once analysis of raw data starts on the 1st of November, 2018, it will become increasingly difficult to remove the influence of your data on the results.

The results of this project will be published in my MHIT thesis and will be available through the University of Canterbury library. There may be further publications from this research however, you may be assured of the complete confidentiality of data gathered in this investigation: your identity will not be made public without your prior consent. To ensure anonymity and confidentiality, you will be given a participant number and this will be the only information that is used to identify you in the transcription and consequential reporting of data. No names will be used. The data will be secrely stored in a password protected folder on the HIT Lab server

and will only be accessible by me or my supervisors. All data will be securely stored and destroyed after 5 years.

Please indicate to the researcher on the consent form if you would like to receive a copy of the summary of results of this project.

The project is being carried out as a requirement of the Master in Human Interface Technology degree by Daniel Gorman, under the supervision of Dr. Bahareh Shahri, who can be contacted at bahareh.shahri@canterbury.ac.nz. She will be pleased to discuss any concerns you may have about participation in the project.

This project has been reviewed and approved by the Human Interface Technology Laboratory at University of Canterbury. If you have any complaints please address them to The Chair, Educational Research Human Ethics Committee, University of Canterbury, Private Bag 4800, Christchurch, human-ethics@canterbury.ac.nz.

If you agree to participate in this study, you are asked to complete the consent form and return it to the researcher prior to starting the focus group.

Daniel Gorman

Focus Group Consent Form (Teachers)

Department: Human Interface Technology Laboratory
Telephone: +64 21 02271413
Email: daniel.gorman@pg.canterbury.ac.nz

Using Immersive Technologies to Support Food Based Education
Consent Form for Teachers

- ☐ I have been given a full explanation of this project and have had the opportunity to ask questions.
- ☐ I understand what is required of me if I agree to take part in the research.
- ☐ I understand that participation is voluntary and I may withdraw at any time without penalty. Withdrawal of participation will also include the withdrawal of any information I have provided should this remain practically achievable.
- ☐ I understand that any information or opinions I provide will be kept confidential to the researcher, Daniel Gorman and his supervisors, Bahareh Shahri, Simon Hoermann and Robert Lindeman and that any published or reported results will not identify the participants or their institutions. I understand that a thesis is a public document and will be available through the library of the University of Canterbury.
- ☐ I understand that all data collected for the study will be kept in locked and secure facilities and will be destroyed after five years.
- ☐ I understand that any audio recording media featuring my voice will not be shared with anyone beyond the researchers.
- ☐ I understand that I can contact the researcher, Daniel Gorman - daniel.gorman@pg.canterbury.ac.nz, or supervisor Dr. Bahareh Shahri - bahareh.shahri@canterbury.ac.nz, for further information. If I have any complaints, I can contact the Chair of the University of Canterbury Educational Research Human Ethics Committee, Private Bag 4800, Christchurch - human-ethics@canterbury.ac.nz
- ☐ I would like a summary of the results of the project.
- ☐ By signing below, I agree to participate in this research project.

Name: _____ Signed: _____ Date: _____

Email address *(for report of findings, if indicated above)*: _____

Please return this Consent Form to Daniel (the researcher) via hard copy in-person or e-mail to daniel.gorman@pg.canterbury.ac.nz.

Focus Group Information Sheet (Students)

Department: Human Interface Technology Laboratory

Telephone: +64 21 02271413

Email: daniel.gorman@pg.canterbury.ac.nz

8 October 2018

Using Immersive Technologies to Support Food Based Education
Information Sheet for Students

Dear Students,

My name is Daniel Gorman and I am a student at the University of Canterbury. I am researching how Immersive technologies, (virtual reality, augmented reality and gaming) can be used in foods education.

I am being supervised by Dr, Bahareh Shahri, Dr. Simon Hoermann and Prof. Robert Lindeman.

I would like you to be a part of a focus group, (meeting) where I talk with you, and a group of other students from your school, about how you learn. I will use the information gained to develop a new activity that could be used to teacher foods skills or knowledge.

I intend to sound record the meeting so that I can type up exactly what is said.

The meeting will be confidential to me and my research supervisors. I will use all the information gained while I am at your school to write a summary of what I learn and this will be used as part of my overall research report.

Participation is voluntary and you are free to withdraw at any stage. If you withdraw I will remove any information, relating to you, from my study. If you are unsure or feeling uncomfortable please talk to your parents, teachers or me about this.

The results of my overall project will be published but you will not be identified in any publication of this research. To ensure your information is kept private I will give you a participant number and this will be the only information that I use when I write up and report on the focus group meeting. All data will be securely stored at the University and will only be accessible to me or my supervisors.

My study is being supervised by Dr. Bahareh Shahri. If you have any concerns you can get your parents to contact her for more information at bahareh.shahri@canterbury.ac.nz.

This project has been reviewed and approved by the Human Interface Technology Laboratory at University of Canterbury. If you have any complaints please talk to your parents or teachers as they know who to contact.

If you agree to participate, please complete the consent form and return it to Daniel prior to starting your focus group.

Daniel Gorman

Focus Group Consent Form (Students)

Department: Human Interface Technology Laboratory
Telephone: +64 21 02271413
Email: daniel.gorman@pg.canterbury.ac.nz

Using Immersive Technologies to Support Food Based Education
Consent Form for Students

- ☐ I have been told about the project and have had a chance to answer questions.
- ☐ I understand what is required of me if I agree to be part of the focus group.
- ☐ I understand that participation is voluntary and I may withdraw at any time without penalty. I understand that if I withdraw after the focus group, all information I provided will be removed from the study but some of what I have said my still have influence on the researcher.
- ☐ I understand that any information or opinions I provide will be kept confidential to Daniel Gorman and his supervisors. I understand that this focus group will contribute to a published document and anything that is published will not identify me.
- ☐ I understand that all data collected for the study will be kept in locked and secure facilities and will be destroyed after five years.
- ☐ I understand that any audio recording featuring my voice will not be shared with anyone beyond the researchers.
- ☐ I understand that I can contact the researcher, Daniel Gorman - daniel.gorman@pg.canterbury.ac.nz, or supervisor Dr. Bahareh Shahri - bahareh.shahri@canterbury.ac.nz, for further information. If I have any complaints, I can get my parents or teachers to contact the Chair of the University of Canterbury Educational Research Human Ethics Committee, Private Bag 4800, Christchurch - human-ethics@canterbury.ac.nz
- ☐ I would like a summary of the results of the project.
- ☐ By signing below, I agree to participate in this research project.

Name:_____Signed: _____Date:_____

Email address *(for report of findings, if indicated above)*:_____

Please return this Consent Form to Daniel (the researcher) via hard copy in-person or e-mail to daniel.gorman@pg.canterbury.ac.nz.

Department: Human Interface Technology Laboratory
Telephone: +64 21 02271413
Email: daniel.gorman@pg.canterbury.ac.nz

8 October 2018

Using Immersive Technologies to Support Food Based Education
Information Sheet for Parents

Dear Parent / Caregiver,

My name is Daniel Gorman and I am a Masters' student at the University of Canterbury. I am conducting research into how Immersive technologies, (virtual reality, augmented reality and gaming) can be used in food-based education.

This study is being conducted under the supervision of Dr, Bahareh Shahri, Dr. Simon Hoermann and Prof. Robert Lindeman. Your child has been identified as a potential member of a student focus group that will meet with me to discuss learning at Middleton Grange School.

The purpose of the focus group is to explore learning at Middleton Grange School so I can develop an intervention (likely a game or virtual reality experience) that has the most likelihood of success in Stage 3 of my study. The focus group will have 5-8 students in it and they will meet with me for approximately 45 minutes. I intend to make an audio recording of the focus group so that I can create an accurate transcript.

The focus group will be confidential to me and my research supervisors and any information gathered through this meeting will be combined, with other data gained during my time at Middleton Grange School, and collated to define the key findings for this stage of my research.

Participation is voluntary and you have the right to withdraw your son/daughter at any stage without penalty. You may ask for any raw data to be returned to you or destroyed at any point. If you withdraw, I will remove information relating to them. However, once analysis of raw data starts on the 1st of November, 2018, it will become increasingly difficult to remove the influence of their data on the results.

The results of this project will be published in my thesis and will be available through the University of Canterbury library. There may be further publications from this research however, you may be assured of the complete confidentiality of data gathered in this investigation: the identity of your child will not be made public. To ensure anonymity and confidentiality, each participant will receive a participant number and this will be the only information that is used to

identify them in the transcription and consequential reporting of data. No names will be used. The data will be securely stored in a password protected folder on the HIT Lab server and will only be accessible by me or my supervisors. All data will be destroyed after 5 years.

Please indicate to the researcher on the consent form if you would like to receive a copy of the summary of results of this project.

The project is being carried out as a requirement of the Master in Human Interface Technology degree by Daniel Gorman, under the supervision of Dr. Bahareh Shahri, who can be contacted at bahareh.shahri@canterbury.ac.nz. She will be pleased to discuss any concerns you may have about participation in the project. If you have any general questions you can contact Daniel on daniel.gorman@pg.canterbury.ac.nz.

This project has been reviewed and approved by the Human Interface Technology Laboratory at University of Canterbury. If you have any complaints please address them to The Chair, Educational Research Human Ethics Committee, University of Canterbury, Private Bag 4800, Christchurch, human-ethics@canterbury.ac.nz.

If you agree to have your son / daughter participate in this study, you are asked to complete the consent form and return it to the researcher prior to the focus group.

Daniel Gorman

Focus Group Consent Form (Parents)

Department: Human Interface Technology Laboratory
Telephone: +64 21 02271413
Email: daniel.gorman@pg.canterbury.ac.nz

Using Immersive Technologies to Support Food Based Education
Consent Form for Parents

- ☐ I have been given a full explanation of this project and have had the opportunity to ask questions.
- ☐ I understand what is required of my son / daughter if I consent for them to be a part of the research.
- ☐ I understand that participation is voluntary and I may withdraw my support at any stage without penalty. Withdrawal will also include the withdrawal of any information my son/daughter has provided, should this remain practically achievable.
- ☐ I understand that any information or opinions my son/daughter provides will be kept confidential to the researcher Daniel Gorman, and his supervisors, Bahareh Shahri, Simon Hoermann and Robert Lindeman and that any published or reported results will not identify the participants. I understand that a thesis is a public document and will be available through the library of the University of Canterbury.
- ☐ I understand that all data collected for the study will be kept in locked and secure facilities and will be destroyed after five years.
- ☐ I understand that any audio recording media featuring my son or daughters voice will not be shared with anyone beyond the researchers.
- ☐ I understand that I can contact the researcher, Daniel Gorman - daniel.gorman@pg.canterbury.ac.nz, or supervisor Dr. Bahareh Shahri - bahareh.shahri@canterbury.ac.nz, for further information. If I have any complaints, I can contact the Chair of the University of Canterbury Educational Research Human Ethics Committee, Private Bag 4800, Christchurch - human-ethics@canterbury.ac.nz
- ☐ I would like a summary of the results of the project.
- ☐ By signing below, I agree to my son / daughter participating in this research project.

Name:_____Signed: _____Date:_____

Son / Daughters Name: _____

Email address *(for report of findings, if indicated above)*:_____

Please return this Consent Form to Daniel (the researcher) via hard copy in-person or e-mail to daniel.gorman@pg.canterbury.ac.nz.

APPENDIX F – Case Study Approval

UNIVERSITY OF CANTERBURY

HUMAN ETHICS COMMITTEE

Secretary, Rebecca Robinson
Telephone: +64 03 369 4588, Extn 94588
Email: human-ethics@canterbury.ac.nz

Ref: 2018/07/ERHEC-LR

11 October 2018

Daniel Leo Gorman
HIT Lab NZ
UNIVERSITY OF CANTERBURY

Dear Daniel

Thank you for submitting your low risk application to the Educational Research Human Ethics Committee for your research proposal titled "Using Immersive Technologies to Support Food Based Education (2)".

I am pleased to advise that this application has been reviewed and I confirm support of the School's approval for this project.

However, the ERHEC note that the next step (the intervention) will require a full application to the ERHEC as there are some risks associated with that proposed phase.

With best wishes for your project.

Yours sincerely

pp R. Robinson

Dr Patrick Shepherd
Chair
Educational Research Human Ethics Committee

Please note that ethical approval relates only to the ethical elements of the relationship between the researcher, research participants and other stakeholders. The granting of approval by the Educational Research Human Ethics Committee should not be interpreted as comment on the methodology, legality, value or any other matters relating to this research.

F E S

APPENDIX G – User Study Ethics Application

Low Risk Application Form

Ethical approval of low risk research involving human participants reviewed by departments or schools in the College of Education

PLEASE read the important notes appended to this form before completing the sections below

Researcher's Name:	Daniel Leo Gorman
Name of Department or School:	Human Interface Technology Lab (HIT Lab NZ)
Email Address:	daniel.gorman@pg.canterbury.ac.nz
Title of Project:	Using Immersive Technologies to Support Food Based Education
Projected Start Date of Project:	7th December 2018
Staff member/supervisor responsible for project:	Bahareh Shahri, Robert Lindeman, Simon Hoermann
Names of other participating staff and students:	
Status of Research: (e.g. Thesis)	Master's Thesis

Brief description of the project:

Please give a brief summary (approx. 300 words) of the nature of the proposal in lay language, including the aims/objectives/hypotheses of the project, rationale, participant description, and procedures/methods of the project:-

In this project I am investigating the potential of immersive technologies, like virtual reality, as a way to teach students food-based, kitchen skills. My research question asks; "How can immersive technologies be used to enhance food-based education in New Zealand secondary schools?" The overall research is a qualitative based exploratory study that includes three key stages. Firstly a series of teacher interviews exploring the necessary skills and attributes students need and the pedagogical approaches used to teach these skills / attributes. Secondly a case study at Middleton Grange School that allowed me to answer my second sub-question "What interventions would be appropriate for this particular school?" The case study also reinforced the findings from stage 1 of my study.

In the third stage, that this application pertains to, I will test a 360 degree video classroom tool that has been developed in consultation with the foods teacher from Middleton Grange School. The intervention includes a series of linked 360 degree videos as well as some text and images designed to highlight key concepts. The goal is that the tool could be used to teach the key Codes of Practice required for working in the foods classroom. I have chosen 360 degree video because it can effectively allow the students to be immersed into a video world, where they can learn key health and safety lessons, as if they are in the kitchen, without having to use precious time in a specialist cooking classroom that is already overbooked. The goal of the intervention is to increase the amount of time students are able to complete practical cooking activities in the kitchens.
To complete the trial the students will use a hand held, Head Mounted Display (HMD), similar to the Google Cardboard, to view the content. During the study I will work alongside the cooking teacher as we guide the students through the 360 degree classroom for about 10 minutes. I have been given permission by Middleton Grange School to continue my research at their school and I expect this will involve working at the school for approximately two hours while I test my intervention with the students.
I am specifically looking at how well the 360 degree environment engages the students through observation of their on-task behaviour, analysis of impromptu comments and through a Likert style questionnaire completed online. I will video record the trials so I can accurately measure the on-task behaviours of the participants and to transcribe any impromptu comments.

Why is this a low risk application?

Description should include issues raised in the Low Risk Checklist (see below).
Please give details of any ethical issues which were identified during the consideration of the proposal and the way in which these issues were dealt with or resolved.

This part of the study is low risk because:

It will be completed with students in a school with a female teacher present at all times. Students will also work in pairs to give them confidence working with adults. All information gained will be confidential to me and my supervisors, and no participants will be identified in any published work. I am an experienced teacher and this research is similar to what a practising teacher might undergo as a regular part of their self-reflective practice, testing a new teaching strategy and evaluating its effectiveness.

- **procedures for voluntary, informed consent**

  The key consent required will be the school through the Principal, the student participants and their parents/caregivers. In each case an information sheet will be provided and suitable time allowed to consider before consent is confirmed. At the commencement of the tests it will be made clear that it is voluntary and that they can withdraw freely at any stage. The following information sheets and consent forms are attached to the end of this application.

  6. An information sheet and consent form that will be given to the Principal seeking formal confirmation prior to commencement.
  7. An information sheet and consent form will be given to the students and their parents / caregivers to complete prior to the study.

The students will be selected by numbering off a list of available students to ensure we get a wide range of participants.

- **privacy & confidentiality**

  No information gathered will be named or used in isolation. Each participant will be given a number and this will be the only reference to them if any in future reporting.

- **how much anonymity can be offered and how it will be maintained**

  The students will not be identifiable as they will be referenced by their student number for example, "Student 1". All information gathered will be kept securely on my computer or in a locked storage at the HIT Lab NZ for a period of five years.

- **risk to participants**

  A key potential risk is me working with junior secondary school and intermediate aged students. As a fully registered and experienced teacher I am fully aware of appropriate safe relationships between adult and student. In order to protect the students I will also ensure, at all stages of the study that there is a female staff member and at least one other student in the room.

  All information will be confidential between the participant, the author and his supervisors, and there will be no reference to the participants by name in any written reporting as part of this thesis.

- **obligations under the Treaty of Waitangi**

  A Māori consultation form has been completed and approved, see copied letter of approval from Henrietta Carroll (on behalf of the NTCEG), at the end of this application.

  The reason for the consultation was that the research involved observations in classrooms, and involved potential interactions with students and teachers who are Māori. My goal is to make them feel as comfortable working with me as possible, giving me a greater chance of hearing their unique perspectives. The overall student roll at Middleton Grange School includes approximately 7% students identified as Māori. It is my intention to try and have at least one student from this cohort as part of my trial and I will ask staff at Middleton Grange School to help me with selection of this participant.

- **needs of dependent persons**

  Not relevant to this study

- **conflict of interest**

  There are no known conflicts

- **permission for access to participants from other individuals or bodies**

  Permissions for the project will be sought as discussed in the procedures for voluntary consent above. This involves permission from the school through the principal and permission from parents for the students to be involved in the study.

  Students involved in the study will receive a $10 voucher as an inducement. However, if the students are released to attend the study during class time there will be no inducement.

- **dissemination of research findings**

  I will share the research findings with the participants in the form of the key findings.

- **storage and subsequent destruction of data**

  Recordings and transcriptions will be securely stored by the researcher and destroyed following the completion of the project.

Applicant's Name:	Daniel Gorman		
Signature:	Daniel Leo Gorman	Date:	26 November 2019

LOW RISK CHECKLIST – *PLEASE ALSO REFER TO THE NOTES AT THE BACK OF THIS DOCUMENT*

Please check that your application / summary has discussed:

- procedures for voluntary, informed consent
- privacy & confidentiality
- how much anonymity can be offered and how it will be maintained
- risk to participants
- obligations under the Treaty of Waitangi
- needs of dependent persons
- conflict of interest
- permission for access to participants from other individuals or bodies
- inducements
- dissemination of research findings
- storage and subsequent destruction of data

Please ensure that Sections A, B and C below are all completed

A SUPERVISOR DECLARATION:

7 I have made the applicant fully aware of the need for and requirement of seeking ERHEC approval for research involving human participants.
8 I have ensured the applicant is conversant with the procedures involved in making such an application.
9 The applicant has individually filled in this Low Risk application form which has been reviewed by me.

Signed (Supervisor):	Bahareh J. M. Shahri	Date:	27/11/2018

B Supported by the Departmental/School Research Committee:

Name:		Signature:		Date:	

C Supported by the Head of Department/School:

Name:	Rob Lindeman	Signature:	Rob Lindeman	Date:	2018-11-30

Please attach copies of any Information Sheets, Consent Forms and/or Questionnaires as appropriate.

Forward **one hard copy and one electronic copy to**:

The Secretary
Educational Research Human Ethics Committee
Level 5 Matariki South (human-ethics@canterbury.ac.nz)

All queries will be forwarded to the applicant within 10 working days of receipt of the application by the Secretary of the committee.

Please include a copy of this form as an appendix in your thesis or course work

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Action taken by Educational Research Human Ethics Committee

☐	Added to Low Risk Reporting Database	☐	Referred to full ERHEC
☐	Referred to another Ethics Committee - Please specify:		
Approved by:		Date:	

NOTES CONCERNING LOW RISK APPLICATIONS

1. ***Procedures:***

   This **Low Risk** application form should **only be used** for proposals which are **Low Risk** as defined in the University of Canterbury Educational Research Human Ethics Committee Principles and Guidelines policy document.

   In consultation with the ERHEC, Departments or Schools will develop a process for review and approval. Departments or Schools will advise ERHEC if there are any subsequent changes to the process.

   The staff making application must sign a declaration that students:

   - undertaking those research projects are being made fully aware of the need for and the requirement of seeking ERHEC approval for all research involving human participants,
   - are conversant with the procedures involved in making such an application,
   - have individually filled in the required applications submitted to the concerned staff.

   A low risk notification form should be filled out and forwarded to the secretary of the ERHEC. Attachments should include a sample of the information and consent forms that will be used.

8. Low risk applications would involve the same risk as might be encountered in normal daily life. For example,

   g. Master's theses where the projects do not raise any issue of deception, threat, invasion of privacy, mental, physical or cultural risk or stress, and do not involve gathering personal information of a sensitive nature about or from individuals.

   h. Master's level supervised projects undertaken as part of specific course requirements where the projects do not raise any issue of deception, threat, invasion of privacy, mental, physical or cultural risk or stress, and do not involve gathering personal information of a sensitive nature about or from individuals.

   i. Undergraduate and Honours class research projects which do not raise any issue of deception, threat, invasion of privacy, mental, physical or cultural risk or stress, and do not involve gathering personal information of a sensitive nature about or from individuals, but do not have blanket approval as specified in Section 4 below.

9. No project, regardless of level, may be considered as low risk if it involves any of the following.:
   a. invasive physical procedures or potential for physical harm
   b. procedures which might cause mental/emotional stress or distress, moral or cultural offence
   c. personal or sensitive issues
   d. vulnerable groups
   e. Tangata Whenua
   f. cross cultural research
   g. investigation of illegal behaviour(s)
   h. invasion of privacy
   i. collection of information that might be disadvantageous to the participant
   j. use of information already collected that is not in the public arena which might be disadvantageous to the participant
   k. use of information already collected which was collected under agreement of confidentiality
   l. participants who are unable to give informed consent, including children
   m. conflict of interest e.g. the researcher is also the lecturer, teacher, treatment-provider, colleague or employer of the research participants, or there is any other power relationship between the researcher and the research participants
   n. deception
   o. audio or visual recording without consent
   p. withholding benefits from "control" groups
   q. inducements
   r. risks to the researcher

   The only exception to this is that research with children and young people in educational settings may be included in applications made within blanket approval category, *provided the skills and strategies being learned are those that would be expected to be part of normal teaching practice on completion of the qualification.*

This list is not definitive but is intended to sensitise the researcher to the types of issues to be considered. Low risk research would involve the same risk as might be encountered in normal daily life.

In some circumstances research that appears to meet low risk criteria may need to be reviewed by the ERHEC. This might be because of requirements of:

- The publisher of the research
- An organisation which is providing funding resources, existing data, access to participant, etc.
- Research which meets the criteria for a review by a Health and Disability Ethics Committee (see HRC website).

10. A separate low risk form should be completed for each teaching or research proposal which involves human participants and for which ethical approval has been considered or given at Departmental or School level.
5. The completed form, **together copies of any Information Sheet or Consent Form**, should be returned to the Secretary, Educational Research Human Ethics Committee, Level 5 Matariki South, and by electronic copy, **as soon as the proposal has been considered at departmental or school level**.
6. The Information Sheet and Consent Form should NOT include the statement "This proposal has been reviewed and approved by the University of Canterbury Educational Research Human Ethics Committee" as this is inappropriate for low risk proposals. A statement such as "This proposal has been reviewed and approved by the Department/School of ….. University of Canterbury" must, however, be used.
7. Please ensure the Consent Form and the Information Sheet has been carefully proofread; the institution as a whole is likely to be judged by them.
8. ERHEC aims to notify applicants for low risk approval within ten working days of receiving the application from the Head of Department/School.
9. The research must be consistent with the UC ERHEC Principles and Guidelines. Refer to the appendices of the UC ERHEC Principles and Guidelines for guidance on information sheets and consent forms.
10. Please note that if the nature, procedures, location or personnel of the research project changes after departmental/school approval has been given in such a way that the research no longer meets the conditions laid out in Section 5 of the Principles and Guidelines, a full application to the ERHEC must be submitted.
17. Ensure that the reference is made to the ERHEC complaints procedure which should be included in the body of the information as follows: Complaints may be addressed to The Chair, Educational Research Human Ethics Committee, University of Canterbury, Private Bag 4800, Christchurch, Email: human-ethics@canterbury.ac.nz.
18. This form is available electronically at the following web address: http://www.canterbury.ac.nz/humanethics/erhec/apply.shtml
19. **Responsibility:**

    Supervisors are responsible for:

    a. Theses where the projects do not raise any issues listed.
    b. Masters level supervised projects undertaken as part of specific course requirements where the projects do not raise any issues listed.
    c. Undergraduate and Honours class research projects which do not raise any issues listed but do not have blanket approval as specified in the Principles and Guidelines.

    HODs are responsible for:

    i. Giving departmental or school approval in principle for the low risk application.
    j. Ensuring a copy of all applications is kept on file in the Department/School.
    k. Ensuring one hard copy and one electronic copy of the application are sent to the secretary of the ERHEC.
    l. Advising the applicant that the project may not commence before the Secretary of the ERHEC has advised final approval (see item 8 above).

The Educational Research Human Ethics Committee is happy to give advice on the appropriateness of research for low risk review.

Principal Information Sheet

Department: Human Interface Technology Laboratory
Telephone: +64 21 02271413
Email: daniel.gorman@pg.canterbury.ac.nz

26 November 2018

Using Immersive Technologies to Support Food Based Education
Information Sheet for Principal

Dear Richard,

My name is Daniel Gorman and I am a Masters' student at the University of Canterbury. I am conducting research into how Immersive technologies like virtual reality, augmented reality and gaming can be used in food-based education. This study is being conducted under the supervision of Dr, Bahareh Shahri, Dr. Simon Hoermann and Prof. Robert Lindeman.

I would like to continue my research at your school to test if the 360 degree video environment I have developed will engage the students. I would like to work with 6-8 students and continue to work with Debbie Johns.

The purpose of my study is to answer my research question;

> *How can immersive technologies be used to enhance food-based education in New Zealand secondary schools?*

In the first part of my study I interviewed specialist foods teachers to explore what they considered the key skills and attributes a student needed to thrive in food-based classrooms. Following this I completed a short case study of the foods programme at your school where I aimed to understand the junior foods context so I could develop an intervention that would be both educational and engaging for the students. In this final stage I am wanting to evaluate a prototype of a 360 degree video environment with the students.

All information gained through this study will be confidential to me and my supervisors and no participants will be identified in further publications that come from this study. The information gathered will be collated, and analysed to establish the key findings.

Participation is voluntary and you have the right to withdraw at any stage without penalty. You may ask for any raw data to be returned to you or destroyed at any point. If you withdraw, I will remove any information relating to you and Middleton Grange School from my research.

The results of this project will be published in my MHIT thesis and will be available through the University of Canterbury library. There may be further publications from this research

however, you may be assured of the complete confidentiality of data gathered in this investigation: your identity and that of your staff and students will not be made public without your prior consent. To ensure anonymity and confidentiality, each participant will be given a participant number and this will be the only information that is used to identify them in the transcription and consequential reporting of data. The data will be securely stored in a password protected folder on the HIT Lab server and will only be accessible by me or my supervisors. All data will be destroyed after 5 years.

Please indicate on the consent form if you would like to receive a copy of the summary of results of this project.

The project is being carried out as a requirement of the Master in Human Interface Technology degree, under the supervision of Dr. Bahareh Shahri, who can be contacted at bahareh.shahri@canterbury.ac.nz. She will be pleased to discuss any concerns you may have about participation in the project.

This project has been reviewed and approved by the Human Interface Technology Laboratory at University of Canterbury. If you have any complaints please address them to The Chair, Educational Research Human Ethics Committee, University of Canterbury, Private Bag 4800, Christchurch, human-ethics@canterbury.ac.nz.

If you agree to participate in this study, you are asked to complete the consent form and return it to Daniel in person or by email to daniel.gorman@pg.canterbury.ac.nz.

Daniel Gorman

Principal Consent Form

Department: Human Interface Technology Laboratory
Telephone: +64 21 02271413
Email: daniel.gorman@pg.canterbury.ac.nz

Using Immersive Technologies to Support Food Based Education
Consent Form for Teachers

- ☐ I have been given a full explanation of this project and have had the opportunity to ask questions.
- ☐ I understand what is required of me if I agree to take part in the research.
- ☐ I understand that participation is voluntary and I may withdraw my support for this research at any time without penalty. Withdrawal of participation will also include the withdrawal of any information pertaining to Middleton Grange School, should this remain practically achievable.
- ☐ I understand that any information or opinions I provide will be kept confidential to the researcher, Daniel Gorman and his supervisors, Bahareh Shahri, Simon Hoermann and Robert Lindeman and that any published or reported results will not identify the participants. I understand that a thesis is a public document and will be available through the library of the University of Canterbury.
- ☐ I understand that all data collected for the study will be kept in locked and secure facilities and will be destroyed after five years.
- ☐ I understand that any video or audio recording media featuring my voice or that of my staff or students will not be shared with anyone beyond the researchers.
- ☐ I understand that I can contact the researcher, Daniel Gorman - daniel.gorman@pg.canterbury.ac.nz, or supervisor Dr. Bahareh Shahri - bahareh.shahri@canterbury.ac.nz, for further information. If I have any complaints, I can contact the Chair of the University of Canterbury Educational Research Human Ethics Committee, Private Bag 4800, Christchurch - human-ethics@canterbury.ac.nz
- ☐ I would like a summary of the results of the project.
- ☐ By signing below, I agree to participate in this research project.

Name: _____ Signed: _____ Date: _____

Email address *(for report of findings, if indicated above)*: _____

Please return this Consent Form to Daniel (the researcher) via hard copy in-person or e-mail to daniel.gorman@pg.canterbury.ac.nz.

User Study Information Sheet (Students)

Department: Human Interface Technology Laboratory
Telephone: +64 21 02271413
Email: daniel.gorman@pg.canterbury.ac.nz

28 November 2018

Using Immersive Technologies to Support Food Based Education
Information Sheet for Students

Dear Students,

My name is Daniel Gorman and I am a student at the University of Canterbury. I am researching how Immersive technologies, (virtual reality, augmented reality and gaming) can be used in foods education.

I am being supervised by Dr. Bahareh Shahri, Dr. Simon Hoermann and Prof. Robert Lindeman.

I would like you to be a part of a user study, where you try out a new 360 degree classroom experience. This study should take about 15 minutes and will involve you using a head mounted display to look at 360 degree images and videos. I will observe how you respond to the activity and then ask you to complete a short online survey. Mrs Johns will also be in the room while we are testing and we will arrange for you to complete the study in pairs.

I intend to video record the session so that I can observe what you are doing at different stages of the study and so I can accurately hear what is said.

Any information gained will be confidential to me and my research supervisors.

Participation is voluntary and you are free to withdraw at any stage. If you withdraw I will remove any information, relating to you, from my study. If you are unsure or feeling uncomfortable please talk to your parents, teachers or me about this.

The results of my overall project will be published but you will not be identified in any publication of this research. To ensure your information is kept private I will give you a participant number and this will be the only information that I use when I write up and report on the focus group meeting. All data will be securely stored at the University and will only be accessible to me or my supervisors.

My study is being supervised by Dr. Bahareh Shahri. If you have any concerns you can get your parents to contact her for more information at bahareh.shahri@canterbury.ac.nz.

This project has been reviewed and approved by the Human Interface Technology Laboratory at University of Canterbury. If you have any complaints please talk to your parents or teachers as they know who to contact.

If you agree to participate, please complete the consent form and return it prior to starting the trial.

Daniel Gorman

User Study Consent Form (Students)

Department: Human Interface Technology Laboratory
Telephone: +64 21 02271413
Email: daniel.gorman@pg.canterbury.ac.nz

Using Immersive Technologies to Support Food Based Education
Consent Form for Students

- ☐ I have been told about the project and have had a chance to answer questions.
- ☐ I understand what is required of me if I agree to be part of the focus group.
- ☐ I understand that participation is voluntary and I may withdraw at any time without penalty. I understand that if I withdraw after the trial, all information I provided will be removed from the study but some of what I have said may still have influence on the researcher.
- ☐ I understand that any information or opinions I provide will be kept confidential to Daniel Gorman and his supervisors. I understand that this focus group will contribute to a published document and anything that is published will not identify me.
- ☐ I understand that all data collected for the study will be kept in locked and secure facilities and will be destroyed after five years.
- ☐ I understand that any video recording will not be shared with anyone beyond the researchers.
- ☐ I understand that I can contact the researcher, Daniel Gorman - daniel.gorman@pg.canterbury.ac.nz, or supervisor Dr. Bahareh Shahri - bahareh.shahri@canterbury.ac.nz, for further information. If I have any complaints, I can get my parents or teachers to contact the Chair of the University of Canterbury Educational Research Human Ethics Committee, Private Bag 4800, Christchurch - human-ethics@canterbury.ac.nz
- ☐ I would like a summary of the results of the project.
- ☐ By signing below, I agree to participate in this research project.

Name:_____Signed: _____Date:_____

Email address *(for report of findings, if indicated above)*:_____

Please return this Consent Form to Daniel (the researcher) via hard copy in-person or e-mail to daniel.gorman@pg.canterbury.ac.nz.

User Study Information Sheet (Parents)

Department: Human Interface Technology Laboratory
Telephone: +64 21 02271413
Email: daniel.gorman@pg.canterbury.ac.nz

28 November 2018

Using Immersive Technologies to Support Food Based Education
Information Sheet for Parents

Dear Parent / Caregiver,

My name is Daniel Gorman and I am a Masters' student at the University of Canterbury. I am conducting research into how Immersive technologies, (virtual reality, augmented reality and gaming) can be used in food-based education.

This study is being conducted under the supervision of Dr, Bahareh Shahri, Dr. Simon Hoermann and Prof. Robert Lindeman. Your child has been identified as a potential participant in my user study. This will involve viewing some 360 degree videos in a head mounted display, similar to a google cardboard.

The purpose of the user study is to explore how engaged students are when viewing 360 degree content. The study will be completed in pairs and Mrs Johns will also assist me with running the study. I intend to video record the session so I can observe what the students are doing at different stages of the study and so I can make an accurate transcription of what is said.

All data including the video recording will be confidential to me and my research supervisors. Any information gathered through this study will be collated to define the key findings for this stage of my research.

Participation is voluntary and you have the right to withdraw your son/daughter at any stage without penalty. You may ask for any raw data to be returned to you or destroyed at any point. If you withdraw, I will remove information relating to them. However, once analysis of raw data starts on the 12th of December, 2018, it will become increasingly difficult to remove the influence of their data on the results.

The results of this project will be published in my thesis and will be available through the University of Canterbury library. There may be further publications from this research however, you may be assured of the complete confidentiality of data gathered in this investigation: the identity of your child will not be made public. To ensure anonymity and confidentiality, each participant will receive a participant number and this will be the only information used to identify them in the transcription and consequential reporting of data. No names will be used.

The data will be securely stored in a password protected folder on the HIT Lab server and will only be accessible by me or my supervisors. All data will be destroyed after 5 years.

Please indicate to the researcher on the consent form if you would like to receive a copy of the summary of results of this project.

The project is being carried out as a requirement of the Master in Human Interface Technology degree by Daniel Gorman, under the supervision of Dr. Bahareh Shahri, who can be contacted at bahareh.shahri@canterbury.ac.nz. She will be pleased to discuss any concerns you may have about participation in the project. If you have any general questions you can contact Daniel on daniel.gorman@pg.canterbury.ac.nz.

This project has been reviewed and approved by the Human Interface Technology Laboratory at University of Canterbury. If you have any complaints please address them to The Chair, Educational Research Human Ethics Committee, University of Canterbury, Private Bag 4800, Christchurch, human-ethics@canterbury.ac.nz.

If you agree to have your son / daughter participate in this study, you are asked to complete the consent form and return it to the researcher prior to the study.

Daniel Gorman

User Study Consent Form (Parents)

Department: Human Interface Technology Laboratory
Telephone: +64 21 02271413
Email: daniel.gorman@pg.canterbury.ac.nz

Using Immersive Technologies to Support Food Based Education
Consent Form for Parents

- ☐ I have been given a full explanation of this project and have had the opportunity to ask questions.
- ☐ I understand what is required of my son / daughter if I consent for them to be a part of the research.
- ☐ I understand that participation is voluntary and I may withdraw my support at any stage without penalty. Withdrawal will also include the withdrawal of any information my son/daughter has provided, should this remain practically achievable.
- ☐ I understand that any information or opinions my son/daughter provides will be kept confidential to the researcher Daniel Gorman, and his supervisors, Bahareh Shahri, Simon Hoermann and Robert Lindeman and that any published or reported results will not identify the participants. I understand that a thesis is a public document and will be available through the library of the University of Canterbury.
- ☐ I understand that all data collected for the study will be kept in locked and secure facilities and will be destroyed after five years.
- ☐ I understand that any video recording media featuring my son or daughter will not be shared with anyone beyond the researchers.
- ☐ I understand that I can contact the researcher, Daniel Gorman - daniel.gorman@pg.canterbury.ac.nz, or supervisor Dr. Bahareh Shahri - bahareh.shahri@canterbury.ac.nz, for further information. If I have any complaints, I can contact the Chair of the University of Canterbury Educational Research Human Ethics Committee, Private Bag 4800, Christchurch - human-ethics@canterbury.ac.nz
- ☐ I would like a summary of the results of the project.
- ☐ By signing below, I agree to my son / daughter participating in this research project.

Name:_____Signed: _____Date:_____

Son / Daughters Name: _____

Email address *(for report of findings, if indicated above)*:_____

Please return this Consent Form to Daniel (the researcher) via hard copy in-person or e-mail to daniel.gorman@pg.canterbury.ac.nz.

APPENDIX H – User Study Approval

UNIVERSITY OF CANTERBURY
Te Whare Wānanga o Waitaha
CHRISTCHURCH NEW ZEALAND

HUMAN ETHICS COMMITTEE

Secretary, Rebecca Robinson
Telephone: +64 03 369 4588, Extn 94588
Email: human-ethics@canterbury.ac.nz

Ref: 2018/09/ERHEC-LR

18 December 2018

Daniel Leo Gorman
HIT Lab NZ
UNIVERSITY OF CANTERBURY

Dear Daniel

Thank you for submitting your low risk application to the Educational Research Human Ethics Committee for your research proposal titled "Using Immersive Technologies to Support Food Based Education (3)".

I am pleased to advise that this application has been reviewed and I confirm support of the School's approval for this project.

With best wishes for your project.

Yours sincerely

pp R. Robinson

Dr Trish McMenamin
Deputy Chair
Educational Research Human Ethics Committee

Please note that ethical approval relates only to the ethical elements of the relationship between the researcher, research participants and other stakeholders. The granting of approval by the Educational Research Human Ethics Committee should not be interpreted as comment on the methodology, legality, value or any other matters relating to this research.

F E S