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Education for Food Literacy

Wendy Slatter

A thesis submitted in fulfilment of the requirements for the
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Abstract

The aim of this research project was to investigate the attributes of a 21st century technological food literacy in order to build a model of technological food literacy education that may enable foods teachers to develop their pedagogy. An interpretivist research methodology framework was adopted that utilised research instruments of semi-structured interviews, Likert questionnaires, a Delphi methodology and document analysis.

The Food Technology Literacy Model development was based on the premise that food is a technological outcome. This model illustrates how the essence of the philosophy of technology can be linked with underpinning components of new nutrition science. This model was tested when the data contributions from food experts was added, in order to see if this data could be linked to these underpinning perspectives.

The research explored food experts’ opinions of what were the essential elements of food literacy. These essential elements provided the information to populate the food technology literacy model that ultimately provided a template for a technological food literacy education programme.

How teachers interpreted the food technology literacy model for their classroom programmes and their pedagogy was examined to provide illustrations of how practising teachers translated their understanding of the components of technological food literacy into their pedagogy. The teachers were able to express ways in which the components of technological food literacy could be actioned and accessed in the classroom. They found that the components of technological food literacy offered an authentic context upon which to scaffold learning experiences. It was found that the model provided the capacity to conceptually frame the foods teacher’s pedagogy in a way that recognised the many components of teacher practice and the components of technological food literacy. This capacity has been expressed as a pedagogical content knowing model for food technology education (PCKgt).

The findings demonstrate that the pedagogy of food technology teachers can be analysed through this model and will contribute to the pedagogy for an education for food literacy for the 21st century.
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Table of Contents

Abstract ........................................................................................................................................ ii
Acknowledgements ...................................................................................................................... iii
List of Tables ................................................................................................................................ viii
List of Figures .............................................................................................................................. viii
Glossary ....................................................................................................................................... ix

Chapter 1: Introduction – Teaching for Food Literacy ................................................................. 1
  1.1 Food glorious food .................................................................................................................. 1
  1.2 My view of food education .................................................................................................. 4
  1.3 Exploring the dimensions of food literacy .......................................................................... 6
    1.3.1 Food insecurity .................................................................................................................. 6
    1.3.2 Curriculum focus on nutrition .......................................................................................... 7
    1.3.3 The development of technology education .................................................................... 8
    1.3.4 Economic contributions ................................................................................................... 8
    1.3.5 Food as an expression of a country’s cultural heritage .................................................. 9
    1.3.6 Summary .......................................................................................................................... 10
  1.4 Outline of thesis .................................................................................................................... 11

Chapter 2: Literature Review .................................................................................................... 13
  2.1 Introduction .......................................................................................................................... 13
  2.2 Food is a Technological Outcome ....................................................................................... 14
    2.2.1 The process of infant milk production ......................................................................... 18
  2.3 The Giessen Declaration ....................................................................................................... 20
  2.4 The Giessen Declaration given a technological perspective ............................................... 22
    2.4.1 Technological knowledge ............................................................................................... 23
    2.4.2 Technological volition .................................................................................................... 24
    2.4.3 Technological activities .................................................................................................. 25
    2.4.4 Technological artefacts .................................................................................................. 26
    2.4.5 Summary of baby formula production .......................................................................... 27
  2.5 The philosophy of technology in teaching about technology ............................................. 28
  2.6 Definitions of food literacy ................................................................................................. 30
    2.6.1 Food literacy definitions from the United States ............................................................ 30
    2.6.2 Food literacy definitions from the United Kingdom and Europe .................................. 31
    2.6.3 Food literacy definitions from Asia-Pacific .................................................................. 32
    2.6.4 Summary of food literacy definitions .......................................................................... 33
  2.7 Formal food technology education curricula ....................................................................... 34
    2.7.2 Summary ........................................................................................................................ 37
  2.8 A conceptual frame for modern food technology ............................................................... 37
Chapter 4: Findings: Experts’ Perspectives about Food Literacy for Food Education ........................................81

4.1 Introduction ........................................................................................................81

4.2 Food experts’ views ..........................................................................................81

4.3 Interview ideas ....................................................................................................82
## Chapter 5: Findings: Teachers’ Views of the Populated Food Technology Literacy Model for Education

5.1 Introduction .................................................................................................................. 105
5.2 Exploring and explaining the components ................................................................. 105
  5.2.1 Social system ........................................................................................................ 108
  5.2.2 Biological system ............................................................................................... 114
  5.2.3 Technological activity ........................................................................................ 116
  5.2.4 Critiquing the components of the model ............................................................ 128
5.3 Combining the populated food technology literacy model and the teachers’ perceptions of the components ............................................................... 129
5.4 Summary ..................................................................................................................... 132

## Chapter 6: Findings: Technological Food Literacy Pedagogical Content Knowing

6.1 Introduction .................................................................................................................. 134
6.2 Exploring a model for technological food literacy pedagogical content knowing .... 134
  6.2.1 Suggested key components of technological food literacy .................................. 135
6.3 Planning to teach a component of technological food literacy .................................. 136
6.4 The PCKgft of teaching a component of technological food literacy ......................... 139
  6.4.1 Programme 1: Samy’s PCKgft ......................................................................... 139
  6.4.2 Programme 2: Pippin’s PCKgft ....................................................................... 142
  6.4.3 Programme 3: Helen’s PCKgft ......................................................................... 145
6.5 PCKgft mechanism ....................................................................................................... 147
  6.5.1 Knowledge of pedagogy .................................................................................... 151
  6.5.2 Knowledge of subject matter ........................................................................... 152
  6.5.3 Knowledge of students ..................................................................................... 154
  6.5.4 Knowledge of wider environmental contexts .................................................... 156
6.6 Summary ...................................................................................................................... 157

## Chapter 7: Discussion and Conclusion

7.1 Introduction .................................................................................................................. 161
  7.1.1 Chapter structure ............................................................................................... 162
7.2 The attributes of food literacy ...................................................................................... 162
  7.2.1 The attributes of a food literate person ............................................................... 163
Appendices .................................................................................................................. 181
Appendix A Defining the experts ............................................................................. 182
Appendix B Indicative Focus Group Questions ....................................................... 183
Appendix C Initial indicative open ended interview questions .............................. 187
Appendix D Teacher Planning Template ................................................................ 191
Appendix E Phase One Questionnaire 1 Likert in the Delphi Sequence .................. 195
Appendix F Phase One Questionnaire 2 Likert in the Delphi sequence .................... 197
Appendix G List of Participant Information Sheets and Consent Forms used within project ........................................................................................................................................... 201
Appendix H Coding rules for Expert Interview Data ............................................. 202
Appendix I Selection of Participant Information Sheets and Consent Forms used within project ........................................................................................................................................... 203
Appendix J Helen’s coat stand diagram ................................................................... 211
Appendix K Helen’s unit plan and task documentation ........................................... 212
Appendix L Helen’s student work exemplars ......................................................... 217
Appendix M Samy’s PCKgft mechanism model ....................................................... 218
Appendix N Pippins PCKgft mechanism model ....................................................... 219
References .................................................................................................................. 220
List of Tables

Table 1. Essence statement descriptors for sections of the theoretical food technology literacy model, indicating source key phrases from the literature ................................................................. 49
Table 2. Focus group participant demographic information ................................................. 60
Table 3. Administration of research question, data collection and participant selection .......... 63
Table 4. Audit trail of research questions, data collection methods, timelines and data analysis ..... 66
Table 5. Themes and subthemes of an ‘ideal’ food literate person from expert interviews .......... 83
Table 6. Final list of suggested components of technological food literacy .............................. 90
Table 7. Populating the populated food technology literacy model—with key phrases from the experts (Giessen and Mitcham) that align with essence statements that have been informed from literature ........................................................................................................ 93
Table 8. Final list of suggested components of technological food literacy ............................ 106
Table 9. Focus group analysis – social system – Food hygiene .............................................. 108
Table 10. Focus group analysis – social system – Cultural dimension and significance of food .... 111
Table 11. Focus group analysis – social, biological and environmental systems – Systems that underpin food ........................................................................................................ 113
Table 12. Focus group analysis – biological dimension – Health-giving properties of food ...... 115
Table 13. Focus group analysis – technological activity – Application of cookery skills ............ 117
Table 14. Focus group analysis – technological knowledge – Use of literacy and numeracy skills 119
Table 15. Focus group analysis – technological knowledge – Sensory experience of food ........ 121
Table 16. Focus group analysis – technological knowledge – Menu planning and food purchasing decisions ........................................................................................................ 123
Table 17. Focus group analysis – technological knowledge – Food preparation from scratch .... 124
Table 18. Focus group analysis – technological volition – Critical thinking and decision-making about food .................................................................................................................. 126

List of Figures

Figure 1. The theoretical food technology literacy model ......................................................... 52
Figure 2. Excerpt from Phase One Questionnaire 1 Likert in the Delphi sequence .................. 85
Figure 3. Excerpt from Phase One Questionnaire 2 Likert in the Delphi sequence .................. 88
Figure 4. Exemplar of component of food literacy definition .................................................... 89
Figure 5. The analytic tool – a generic example – moving from the theoretical to a populated food technology literacy model ................................................................................. 92
Figure 6. The populated food technology literacy model .......................................................... 102
Figure 7. The analytic tool – extended for focus group analysis – generic example ................. 107
Figure 8. The food technology literacy education model .......................................................... 131
Figure 9. PCKgt model ............................................................................................................. 138
Figure 10. Samy’s PCKgt ........................................................................................................ 139
Figure 11. Pippin’s PCKgt ....................................................................................................... 142
Figure 12. Helen’s PCKgt ....................................................................................................... 145
Figure 13. Model of PCKgt mechanism .................................................................................... 148
Figure 14. Helen’s PCKgt Mechanism Model ......................................................................... 150
Figure 15. The populated food technology literacy model, reproduced from Chapter 5 .......... 168
## Glossary

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Food literacy</td>
<td>An emerging term with a variety of definitions.</td>
</tr>
<tr>
<td>Food technology literacy</td>
<td>Knowledge in the field of food technology.</td>
</tr>
<tr>
<td>Technological food literacy</td>
<td>A visual model that defines food literacy.</td>
</tr>
<tr>
<td>Food technology</td>
<td>Refers to the subject ‘Food Technology’ in New Zealand schools.</td>
</tr>
</tbody>
</table>
Chapter 1: Introduction – Teaching for Food Literacy

1.1 Food glorious food

This thesis is about food and is an exploration of a food education appropriate for those who will live through the 21st century. I have been passionate about food education for most of my adult life. I managed to embark on this career pathway as a diversion from what I believed was my true passion as a teenager. My original interest was science, particularly biology. When I was growing up, I declared that my goal was to be a scientist. My father, knowing of my compassion towards living things, told me that being a scientist involved killing. Undeterred, I investigated which branch of science could possibly suit me – it needed to be one in which I did not have the responsibility for taking a creature’s life. I settled on nutrition – after all, you could not possibly kill humans for study, could you? As the years have gone by, I have realised just how wrong I was. In fact, when overnutrition, undernutrition or an inadequate understanding of nutrition exist, there is every likelihood that humans will die. We can assume this situation is caused by our lack of knowledge about food and our inability to access a good diet.

As a young graduate from the University of Otago’s Home Science School in 1986, I was going to change the world. I was passionate about teaching what I had learned about food and nutrition. It was still very early days for New Zealand’s nutrition policies. In fact, the first population-based food and nutrition guidelines for New Zealanders were not published until 1991 (Ministry of Health, 2003). Before that time, there was no easily accessible nutrition guidance information for the public. It was the late 1980s and I was convinced that there should be space to discuss with young children their nutrition needs. However, there was no opportunity within primary school curricula for this to happen. But there was space for food education in secondary schools. This led me to an initial career as a food education teacher. I chose my career path with anticipation.

On reflection, this career has enabled me to share in many people’s lives. Such things as the role of eating and caring within a family life, as well as the nutritional guidelines and goals to follow, were areas of discussion in my classroom. Shortly after my career began, in 1988, the curriculum guidelines guiding our teaching changed and I realised that the educational playing field is not static and changes follow educational priorities.

My life as a teacher had its high and low points. It was fulfilling to work with students and guide them into learning about food and the role it played within families. My students got a lot
of pleasure from creating a successful food product in their practical lessons. But I realised that my view of food was different from that of my colleagues and I felt confined by the school environment. I felt the world outside the classroom door had much more to offer students than just cooking, but it was difficult to negotiate these ideas in the school environment.

After several successful years of teaching, I decided to utilise the skills from my undergraduate degree in other work. Initially, I found work as a home economist for foods companies and primary producer boards. In these roles, I worked with the public as well as a wide variety of people in the foods industries, from farmer producers to butchers and trainees at polytechnics, by communicating and educating about a variety of food products. Later, as a nutrition researcher for a nationwide nutritional status survey, I coordinated a team of nutrition researchers and worked with people who had agreed to be interviewed about their food intakes and health status. Contact with people in these different roles made me even more aware of the necessity for a wider view of food and nutrition. My feeling was that people had a lack of skills and knowledge about food – and as the years progressed, there seemed to be less of this knowledge rather than more.

One area of concern was the level of obesity in New Zealand. The health status statistics of New Zealanders backed up this personal observation. The 1997 National Nutrition Survey indicated that approximately 17% of New Zealand’s adult population were obese, and an additional 35% were considered overweight (Russell, Parnell, & Wilson, 1999). The 2002 Children’s Nutrition Survey showed that about a third of New Zealand children between the ages of five and 14 were either overweight or obese (Ministry of Health, 2003). The 2006/07 New Zealand Health Survey findings showed that one in three New Zealand adults were overweight (36.3%) and one in four (26.5%) were regarded as obese (Ministry of Health, 2011). In 2006–2007, it was calculated that 25% of the New Zealand population over 15 years was likely to be obese.

Another issue being raised in the public arena was the amount and quality of food available to New Zealanders. New Zealand had been considered a place where food is plentiful. However, it was interesting to see the reality. A survey of New Zealanders’ levels of food insecurity was completed in 1997 as part of the National Nutrition Survey. From this research, Parnell, Reid, Wilson, McKenzie and Russell (2001) identified the ability of New Zealanders to access and afford appropriate foods (p. 143). This survey discovered that adult New Zealanders are more food insecure than their counterparts in the United Kingdom or Australia. The survey results also indicated that young New Zealanders suffer from food insecurity issues at an age when healthy eating habits should be developing. They need to do this to avoid future health issues
such as raised cholesterol, osteoporosis and high blood pressure (Parnell et al., 2001). Parnell et al. (2001) concluded that “if prevention is better than cure, action is required now” (p. 145), but these researchers did not indicate what form this prevention should take.

Later studies indicated that food insecurity was an ongoing situation for New Zealanders. This could be explained by the high cost of housing, which consumes a large amount of the household budget, thus affecting the amount of money available for food purchase. This housing problem affects the poverty line for New Zealanders. An Organisation for Economic Co-operation and Development (OECD, 2014) report, Society at a Glance 2014, indicated that after housing costs were considered, one in six New Zealanders reported running out of money for food (Organisation for Economic Co-operation and Development, 2014). The poverty line in New Zealand is defined as families of median income using 60% of this income for housing costs (Ministry of Social Development, 2015). The Ministry of Social Development (2015) released figures showing that in 2012, 27% of New Zealand children lived in homes below the poverty line, an increase from 22% in 2007.

Yet New Zealand is known as a food-producing nation. The gross domestic product employment in food-related industries contributes to 25.3% of our employment (Easton, 2008). It seems such a contradiction to be viewed by the world as a food basket, yet have so many of our population suffer food hardship.

My interest in the wider area of food education was developing a broader perspective than just providing ideas about classroom-based issues. I returned to the classroom to teach food technology. I became interested in the links between what we taught in our core food lessons (up until the age of 14) and the lives our students lived outside the classroom. I wondered if students’ personal lifestyle decisions referenced the food education they had experienced, such as practical cooking experiences and learning about nutrition. At this time, I was also teaching cookery skills in adult education classes and I observed a lack of, what I felt was, simple cookery knowledge. When making gnocchi and the recipe called for the water in which the gnocchi were to be cooked to be held at a “simmer” (a very gentle boil in which the water barely shows movement) – I fielded the question “What’s the simmer and how do I hold it?” In another night class, when talking about basic food preparation and nutrition when reviewing the four food group model, a class member asked, “Is a potato a vegetable?” I wondered how my full-time job as a foods teacher was contributing to a food education for future generations.

I started to think about what knowledge and competencies are needed for students to be food aware. This wider view of food education was also being proposed in the international food
education arena. There seemed to be a pervading sense of unease about people’s levels of food knowledge. Carolyn Steel’s (2008) book *Hungry City: How Food Shapes Our Lives* illuminates the fundamental issue of how food for urban dwellers is processed and provided, and the huge social and physical cost to ourselves and our planet that this activity generated. She shows that we are unaware of the processes that interplay when we are feeding ourselves. Food appears as if by magic, and we rarely stop to think about how it might have ended up on our table. Steel (2008) comments that “food is the most devalued commodity in the industrialised West, because we have lost touch with what it means” (p. 51). This concept seemed so foreign to me and so far removed from my upbringing on a farm, where we grew what we ate and lived by the seasons. And yet, on reflection, I could see what she meant. My experiences with food were so very different from the students I was teaching. For my students, the idea that carrots had green leafy tops and that a whole chicken for roasting looked like an animal was a revelation.

I began to question my role in the classroom, and the importance of my food education programme. Goodson (1993) considered that food education is a low status subject in comparison with other “traditional grammar school preferences” (p. 60). Goodson (1993) and Ross (2000) believe it is regarded as less important because of its focus on the development of practical skills. I could sense that my teaching colleagues in a grammar school regarded my food education courses as being a low stakes subject. It was apparent that acquiring practical skills was a small part of the knowledge that young people needed to eat well and manage their food environments. I was not the only one to see these relationships. The work of Michelle Obama in her presidential initiative Let’s Move! highlighted the need for change in the eating and behavioural habits of the United States’ young people too (The White House, 2010). Her focus was a combined strategy of parenting, environment changes and healthier food in schools (The White House, 2010). Although worthy, this focus did not cover enough and there were additional areas for concern such as food insecurity, food planning and healthy eating.

1.2 My view of food education

The previous section presented my story about my personal interest in the choice of topic and how this related to my professional life. This section explains more about my thoughts about food education in New Zealand.

My position could be regarded as being focused not just on cooking but also the production of food should be underpinned with nutritional knowledge. These views came from the influences of my own upbringing on a farm and my childhood interactions within a Māori community where the cultural role of food was significant, and were then moulded by my undergraduate
degree in nutrition and sculptured by my working life experiences with food products. These experiences have given me an awareness that there are bigger issues interplaying with the choices people make about their food than nutrition, for example, cultural choices and celebrations.

My pedagogy was influenced by the technology curriculum learning area of *The New Zealand Curriculum* (Ministry of Education, 2007), in which a creative, problem-solving, student-centred approach was utilised.

My broader view of food was not echoed by curriculum directions. Teaching in food education in New Zealand now follows two main pathways under *The New Zealand Curriculum* (Ministry of Education, 2007). Teachers can choose to work within earlier guidelines provided by *Technology in the New Zealand Curriculum* (Ministry of Education, 1995) or *Health and Physical Education in the New Zealand Curriculum* (Ministry of Education, 1999). Both curricula are supposedly compulsory areas of study until the end of Year 10. However, schools often choose to teach foods only in one compulsory area. In senior secondary school, schools can select up to three pathways for food education: that of technology, health and physical education (HPE), or industrial training units. Each curriculum has its own goals in providing foods-based learning opportunities for students.

I felt that my teaching world and small teaching area had become crowded with guidance and advice on what to teach in food education and how to teach it. In 1988, when I commenced my teaching career, foods was taught by following examination prescriptions for identified technical practice of skills and techniques. Then at our school we adopted the home economics curriculum, which defined family-oriented lifestyle and living skills as teaching priorities. In the 1990s, I was introduced to a technology curriculum in which technological literacy was developed through the creation of a product. Alternatively, I could adapt to teaching foods within the HPE curriculum, where lifestyle, nutrition and health were important. At the same time, Industry Training Organisations developed foods training guidelines in which the concepts of practical skill development and food safety needed to be taught. All of these curriculum approaches encourage reflection on the link with and role of food in society but with different emphases (Ministry of Education, 1995, 1999).

I was motivated to find out what was an appropriate food education for 21st century students. My interest was focused on what were considered the elements of practice that food teachers needed to consider in developing a 21st century food literate person. For me, teaching about food has always been underpinned by the same commonality of food but the philosophy
surrounding the “how to” teach about food continued to cause me concern. Underpinning this concern were my own teaching experiences. Through the years, I have taught in a variety of schools and with some very experienced home economics teaching colleagues. Even though they had experience with alternative curriculum foci as well as years of classroom experience, many found it challenging to work within the technology curriculum directions as identified in the 1995 curriculum document. I wondered why. There seemed to be a lack of intersection of the ideas between what was important in the curriculum and what teachers thought was important to teach. This led me to thinking about what we were trying to accomplish with our students. While commencing this study, I was beginning to question what philosophy underpinned foods teaching pedagogy.

To summarise, there has been much change in the teaching of foods in schools since the 1980s, and yet it appears that very little research has been conducted into the reasons for this changing focus. There is also limited recognition of the importance of food education for New Zealanders’ health and economic prosperity, or as a reflection of their culture.

1.3 Exploring the dimensions of food literacy

This introduction was written to justify my views that food literacy is more than knowing how and what to eat. In fact, it involves dimensions of food security, nutrition and economic contributions the food industry makes to our society, as well as expression of our cultural heritage. The academic issues will be discussed in the literature review chapter, but in this chapter I discuss what I believe food literacy should entail.

1.3.1 Food insecurity

In 1995, while I was working on a nutrition research survey, part of my work was to trial and pilot an initial study to determine whether, when the study went nationwide, the interviewing process would work and data would be collected accurately. For the first time in New Zealand, questions regarding the participants’ food security status, such as their feelings about accessing food and any difficulties they might experience, were included as part of the research.

During this 1996 trial, in developing these questions with New Zealanders, I felt for the participants. I noted in their responses a hesitation to admit to a stranger the true depth of emotional distress that the inability to provide food for their family created for them. This distress was further compounded when they were expected to cater for family and cultural events. When the research survey teams went national, we were encouraged to annotate the file if we felt that a level of tension or stress from the respondents might have influenced them to be
more positive in their response. Coming from a remote farm community where excesses (such as when the net was full of flounder or the seasonal glut of vegetables occurred) were shared openly and freely with those without, I found it was still an eye-opener to feel the stress from the respondents when they had to speak of an inadequacy in accessing sufficient food. The memory remained with me and when I returned to teaching I noted that the experience had influenced me. I ensured that my classroom fridge held a bag of apples or carrots and the cupboard a bag of oatmeal porridge and sugar for the hungry. I made sure this action was the same in all of my schools, no matter what decile rating the school had. And yes, it was quietly accessed by pupils just as much in the decile 10 school as it was in the decile 1 school. Consequently, for me, a level of food literacy involves an awareness of what it is to be food secure, and how a state of personal food insecurity can create wider health status issues within ourselves, our society and our global community.

1.3.2 Curriculum focus on nutrition

As a School of Home Science undergraduate, I studied the same nutrition papers as the medical, general practice and dietetic students. My personal interest in nutrition, which I defined as “understanding the science of food, eating it and how it affected the human body”, was the reason I went to the Home Science School in the first place: in the 1980s it was the only place in New Zealand to study nutrition. To me, these nutritional science papers combined with a food science aspect of the course (understanding the cooking processes and changes) strongly supported my development as a food teacher. I began to understand the nutritional background to foods as well as how processing food into products changed their nutritional make-up.

This background fitted well with the nutrition education taught in New Zealand schools at the time. In 1985, a national syllabus for home economics for Forms 1–4 (11 to 14 year olds) was written and it was regarded as the first direction statement for New Zealand home economics teachers (Street, 2006). In later years, this syllabus provided a foundation for home economics to be amalgamated into the HPE curriculum (Ministry of Education, 1999). Schools had a choice of where to place food education: within the technology curriculum released in 1995, or within the HPE curriculum released four years later. I felt that this timing gap between the two curricula created an unhealthy scenario between colleagues of “Are you a ‘home eccer or a techie’ teacher?” It felt as if a once tightly knit collegial group was being slowly ripped apart by

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1 The school decile system indicates the degree to which schools draw their students from low socio-economic communities. Targeted funding to the school to help overcome barriers to learning that the students might face is then generated. The lower the school’s decile, the more funding is received. Source: Ministry of Education (2016).
the professional decisions we were making about our pedagogy. I could not understand why we needed to choose.

1.3.3 The development of technology education

As a teacher, I often found myself challenged by foods teacher colleagues – not because of my education, but because of my personal choice of pedagogy. The development of the technology curriculum aroused my interest in the things I thought were missing in the existing home economics syllabi, which had morphed into the HPE curriculum. I wanted the foods created by my students to be authentic, real and related to their interest and I felt this avenue was strongly supported by the technology curriculum. I wanted their food development ideas to be driven by a need – the student’s need or interest – and not just “what Miss said we had to make this week”. As I declared my interest in teaching within the technology curriculum, I was made to feel by my colleagues that I had abandoned all forms of nutritional knowledge and training: It was considered that by teaching within a technology curriculum, I had somehow thrown the baby (nutrition) out with the bathwater (by not teaching the health curricula). Yet all I could see was the authentic learning opportunities for my students in the mix of nutritional issues presenting itself to my classroom door in the form of the obese, anorexic, sports-mad and pregnant students. For me, a food literate person would display some knowledge of basic nutritional facts and how it could interact with their personal nutrition needs.

1.3.4 Economic contributions

Because of my upbringing and education, I assumed that all New Zealanders had some level of awareness that our primary food producers formed the economic backbone of our country. Historically, New Zealand was developed as an exporting nation of food products (Wakefield & Ward, 1837). As the daughter of a farm manager, I knew the success of the farm relied on my father being able to produce consistent quality lambs for the fat lamb draft and beef cattle for the meat buyers who would turn up at regular intervals through the year. I understood the simple economics of a long, hot, dry summer: dry ground meant no feed, which meant less stock, which meant a scarcity of meat product in markets. I thought everyone realised that New Zealand supported a broad range of foods-related industries that created employment opportunities and wealth for New Zealand. As a teacher, I thought the rumours of students not understanding where their food actually came from was a bit of a tale and happened in other countries like England and the United States but not in New Zealand.

So it was an interesting experience to realise that many students had no idea where the food products they consumed came from or how they got onto the supermarket shelves. One day a
student found me washing potatoes before class and asked me why. When I explained I was just removing the loose dirt before the students washed them themselves, she was shocked. Her reply was “You mean, you mean, they grow in the ground?” I nodded and asked her where she thought they were from. She mimicked picking them off a tree.

In a Year 9 class we would explore the supplier chain for eggs as a homework assignment and then a think-pair-share exercise, with the final chain being drawn up on the whiteboard. Quite often students could think backwards to the first link, that eggs came from chickens. From there we got a random collection of ideas – they knew that the eggs came from a factory that put the eggs in boxes but they had no idea where the chickens lived or who looked after them, what the chickens ate to make the eggs to put in the boxes in the factory or that even people were involved in the manufacturing chain. The ideas got even more bizarre if I used a manufactured imported product such as a chocolate bar. I thought that people who displayed a level of food literacy would understand the role food plays in a country’s economic success.

1.3.5 Food as an expression of a country’s cultural heritage

Food contributes to significant cultural patterns of a country and its people. It contributes to our quality of life and is often the way that significant life events are shared – for example, birthday parties, wedding receptions and wakes. Often, significant family cultural heritages are bound by the passing on of secret traditional family recipes. For example, my mother taught me the bread recipes that her mother taught her, which she, in turn, learned from her German mother-in-law, who arrived in New Zealand in the 1870s. Like my mother, I was taught these recipes because I was the youngest child, which meant that the tradition would then exist for a longer time. For example, in my family, Christmas with the children has to involve carrying around and admiring the “baby bread” (Stollen) straight out of the oven on Christmas morning. Easter is celebrated with the baking of “sugar cooking” (Strueselkuchen), a sugar-topped spicy fruit bread.

I grew up in a remote, predominantly Māori community. Our wee community was well served by a church, a school and a marae. The marae featured large in our community. It was the focal point of celebration, of traditional practice and of social activities. Everyone in the community played a role. As kids our job was out the back, as ringawera (“hot hands”) in the kitchen. We would complete a variety of tasks, from peeling potato after potato for the hāngī, to mixing up burnt sugar puddings, setting the table, folding napkins, and dishes, dishes, dishes. I learned certain Māori cultural traditions with food that lingered long after I left the area. You never sat on tables – bottoms were dirty and tables were for food. As a sign of respect, you ate after the elders. You washed the tea towels separately because they were used for food.
There were also food traditions in the world outside of our farming area. As a small child, I went with my parents to the stock sales days in town, and I remember the food that was there. All the farmers’ wives congregated on sales days with the best of their baking to tempt the farmers and buyers who came. Farmers and stock agents needed portable food in a hurry, and if it could have lashings of cream on it, all the better – and ours was the best cream because we had our own milking cows and cream separator.

Carter and Maynard (2001) comment that food “has a value in helping us understand everyday life in New Zealand, and everywhere else on this planet” (p. 89). Identifying people’s level of food literacy involves an exploration of their cultural heritage as it quite simply expresses part of who they are.

1.3.6 Summary

An exploration of some of the dimensions of food has provided an insight into the rich complexity of the subject. Four broad dimensions of food have been presented. These dimensions provide a backdrop of different perspectives about the same issue – food.

However, taking a step away from such perspectives is important as such a close view may influence the way food concepts are defined and explored. In order to deepen the potential characterisation of food literacy, the interaction of food and people is now investigated. This investigation results from the idea that each food dimension mentioned is underpinned by the interaction between food and humans.

My opinion is that although we educate about food, there is no common underlying thread underpinning that formal education. I believe we have arrived at this point because there is a disconnect between how we have educated about food in the past and what we need to educate for in our future. As the elements of food literacy have not yet been characterised, this job is challenging. It is difficult to equip our future citizens because we do not know which skills or knowledge contribute to these food education elements.

There appears to be a lack of a coherent educational policy on food education in New Zealand. There is a clear signal of a belief that citizens should be foods educated because food finds a place in three curriculum areas. However, I believe this multiplicity also signals a lack of comprehension of what it is about food that we are actually trying to teach. The dimensions of food suggest that such literacy could be underpinned with education about food and nutrition and being able to “cook from scratch”. Other food dimensions include valuing food as a commodity and using food as a dimension of social storytelling about a nation’s cultural
heritage. I contend that these elements may form part of a citizen’s food literacy, but perhaps there are other dimensions that have yet to be considered. It is unclear from curriculum guidelines which elements of food education are expected to be or are taught to every citizen in New Zealand; hence, the need for a characterisation of food literacy to be developed.

Since formal education has a strategic role in changing people (United Nations Educational, Scientific and Cultural Organization, 2007), it follows that teachers are the change agents. To be effective change agents, teachers need to be equipped with clear guidance on what constitutes effective teacher practice about food and what elements of and about food should be taught. The major aim for this research was to identify the elements of food literacy and how it could be taught to develop a 21st century food literate person. As a result, research questions were developed to explore the issue of food education for the 21st century, and the initial research question, “What are the attributes of a food literate person?” framed the initial investigation for this study.

1.4 Outline of thesis

This thesis is divided into seven chapters. Chapter One has presented an introduction to the research project and described my opinions and beliefs about food education. It argues for the development of the elements of a food literacy education that will underpin the characteristics of a food literate 21st century person.

The second chapter reviews the literature associated with food internationally and from a technological perspective. The position that food is a technological outcome is justified. Food education internationally and within New Zealand is explored and an investigation into learning theory and pedagogy is conducted. The chapter concludes with the proposal of a theoretical food technology literacy model.

The third chapter describes the methodology, research design, data collection and analysis used within this research project. Issues of the project’s legitimation and a consideration of the ethics in accessing participants are provided.

The fourth chapter discusses the first two research questions, firstly, considering how food experts describe the attributes of a technologically food literate person and, secondly, indicating which components of these are deemed essential for inclusion in a technological food literacy education programme. The theoretical food technology literacy model is populated with the views of the food experts.
The fifth chapter reports on the research question related to teachers developing a technological food literacy education programme. An explanation of how they perceive the components of a technological food literacy and how they might be taught is provided. The food technology literacy model is populated with the views from the teachers.

The sixth chapter considers the implications for teacher practice following a trial by teachers that incorporated a component of technological food literacy within their teaching programme. The final food technology literacy model is trialled and populated with these teaching and learning ideas. A model that expresses the enactment of teaching with the food technology literacy model as a pedagogical content knowing model as it relates to the practice of these food technology teachers is presented and populated.

Chapter 7 concludes the thesis with a discussion of the findings and concluding remarks. A summary of the findings is given. How the teachers interpreted the food technology literacy model and the implications this has for foods teacher pedagogy content knowing is discussed. Limitations of the research study are indicated and suggestions for future research are given.
Chapter 2: Literature Review

2.1 Introduction

A key focus of the literature review is to provide a conceptual framework through which the wide range of views about food can be considered. Furthermore, this review considers international trends in food education and identifies what educational approaches have been made towards developing a student’s technological food literacy.

First, in Section 2.2, the background to the position this thesis takes, that food can be seen as a technological outcome, will be explained. This position will be supported by the views of McGinn (1978), Mitcham (1994), Pitt (2000) and Scharff and Dusek (2003).

Section 2.3 introduces the Giessen Declaration (Beauman et al., 2005). This founding document provides a framework for the researcher to use to explore and explain the relationships between food and nutrition. Consequently, the Giessen Declaration (Beauman et al., 2005) provides a way to anchor an ontologic technological perspective about food.

As a consequence of this positioning, a way of categorising technological food outcomes through the Giessen Declaration 2005 (Cannon & Leitzmann, 2006) will be explored and the relationship between these two aspects will be explained in Section 2.4.

In current literature about technology education, it is argued that the philosophy of technology should be expressed in curricula and be used as a guide to inspire developments with technology education. Therefore, it is relevant to consider this perspective and it is explored in Section 2.5.

It will be argued that the Giessen Declaration (Beauman et al., 2005) and the philosophy of technology can be combined to form a model for technological food literacy. Therefore, it is relevant to consider existing definitions of food literacy from around the globe, and these are presented in Section 2.6. Section 2.7 considers food technology education curricula that are underpinned by a philosophy of technology that embraces all of the possible dimensions of food.

In Section 2.8, research relating to the development of a conceptual frame for modern food curricula is described as this informs the development of a model for technological food literacy. This section argues that to educate in food for the 21st century, we need to adopt a different perspective of education for technological food literacy. Underpinning this research is the idea that food is a technological outcome, and can be categorised by the ideas expressed in
the Giessen Declaration (Beauman et al., 2005). This section presents a proposed model that reflects this diversity of inputs and outcomes.

Because this thesis considers how to scaffold learning towards the goal of technological food literacy, it is pertinent to consider those theories that seek to explain learning. A review of learning theory is presented in Section 2.9, with particular reference to the New Zealand curriculum and theories about learning that consider learning through experience and activity.

Food technology teachers are often the providers of learning experiences in food education. As a result, it is appropriate to consider the idea of pedagogical content knowledge (PCK) as teachers’ PCK frames the learning experiences that they scaffold for their students and bridges the gap between content knowledge and the practice of teaching. This is presented in Section 2.10.

A summary in Section 2.11 is provided of the key aspects presented in Chapter 2 to that point. A theoretical model for food technology literacy is presented in Section 2.12. The key research questions that guide this research are presented in Section 2.13.

### 2.2 Food is a Technological Outcome

The context of this thesis is food. Overall, the aim of this research was to investigate the attributes of food as a context in the 21st century in order to build a current model of food technology literacy education. This thesis argues that the decision to consume food suggests means that during its preparation it has undergone a technological process and become a technological outcome. That is, the essence of food and how the world of food is viewed can be identified by treating food as a technological artefact, that is, food items and processes. This may be viewed as a controversial and novel way to view food and some perspectives may not accept that food can be viewed in this way.

Nonetheless, this thesis makes the argument that the decision to transform items to be digestible, non-poisonous and pleasurable food items that one consumes involves a technological process of planning, design and transformation. This process results in a technological product.

At this point, it seems fruitful to look at the issues of food from a philosophical viewpoint because our society has a technologically based ontology that we are often unaware of. The researcher argues that this ontology deserves to be examined more closely when one is investigating issues to do with food. This thesis has a focus on education, within a food context. Food itself contains knowledge as a technological product and provides the frame of reference.
for food education within appropriate technology curricula and pedagogy. It is valuable to explore these influences and effects of food from a philosophical viewpoint as this provides a foundation and justification for food being a context within an appropriate technology curriculum and pedagogy.

When examining technology, it is useful to examine Mitcham’s (1994) ideas about how a domain is justified in terms of its epistemology, that is, the nature of its knowledge, its ontology, the inherent activity that underpins the domain and explains how things happen, and the volition or human will that influences and controls its direction.

Mitcham (1994), in his examination of technology, suggests that technology is central to human activity: people combine technological knowledge and technological volition to produce technological activities and technological objects in our world. Mitcham (2001) quite simply suggests that technology is “the making and using of artifacts” (p. 1). Mitcham also suggests that technology is richly complex, requiring some system of classification that he characterises within the philosophy of technology. This classification system will now be outlined.

Mitcham’s (1994) work provides a conceptual frame that describes these technological categories, termed technological modes. These deeper aspects of technology provide a way to conceptualise the view that food is a technological outcome. Each technological mode is transformed by human interaction, intervention and invention. How we explore these four main modes – epistemology, ontology, activity and volition – that underpin a technology philosophic approach provides an avenue to explore the influences and interactions of food with science, cultures and the environment. Consequently, it is useful to review these modes further. Key terms have been italicised in the following section to provide emphasis and aid the reading.

The first mode, epistemology, in technological terms is where knowledge building occurs and the validity of knowledge is proven. This aspect focuses on the knowledge and skills involved in the technological production and use (Mitcham, 2001). Mitcham considers that technological epistemology is based on fitness for purpose. Technology is regarded as an amalgam of many different disciplines, domains of economics and science, social tools of governance and legal constraints (Pitt, 2000), so that the validity of the end product – the knowledge produced – comes from the use of the developed artefact and whether it works or not. Termed technological knowledge, this is focused closely upon the knowledge and skills used in the making and using of objects. Pitt (2000) supports this idea and comments that technology is “conceived as a complicated process of humanity at work in which knowledge gained by prior action is reconsidered in the light of new knowledge and new actions attempted” (p. 23). Pitt (2000)
argues that if all of these things are brought together to create an object or an outcome and it does not work, then there is no validity in that knowledge. Consequently, a functioning artefact carries within it technological knowledge of prior action and knowledge.

If we place this idea in a food context, food technological knowledge might be evident in following a recipe, where often the words belie a requirement for a greater depth of knowledge. For example, in making a pavlova, a meringue-based cake, the recipe calls for you in part to simply “Place the egg whites into the clean bowl of an electric beater. Add the salt and beat until stiff. Slowly add the sugar” (Langbein, 2013). Pitt’s (2000) explanation that technology can be affected by knowledge from prior action is exemplified in this recipe. What does the instruction beat until stiff actually mean? Without prior experience or knowledge, determining this stage is highly subjective. However, there is technological knowledge in play and recognising this step in the recipe is an important one: if the egg whites are underbeaten when you start to add the sugar, the meringues go back to a liquid mix, but if the eggs are overbeaten at this stage, the sugar will not dissolve and the pavlova will weep sugar syrup once cooked.

The second mode, ontology, Mitcham (1994) argues, is the essence of what exists and how the world is viewed, through technological artefacts, that is, the things and processes that work. This mode of technology is described by Mitcham (1994) as including “all humanly fabricated material artifacts whose function depends on a specific materiality” (p. 161). This is manifested as the objects that we make and use, such as machinery and tools (Mitcham, 2001). When one considers food from an ontological perspective, then the decision to place food into your mouth and consume it becomes evident. Ontologically, food, viewed by humans, is an item that we make and use that will gratify the body. If this occurs the food is considered fit for this purpose. Technological knowledge is involved in this decision-making, initially through the trial and error method of tasting (and the development of knowledge about negative side effects such as poisoning). Technological knowledge is developed to identify and explain how food items are created.

The third mode identified is that of technological activity. Mitcham (1994) identifies the development of a technological outcome as technological activity, which includes all processes, including seeing a need, planning, producing and evaluating as well as the related act of using the produced artefact. Pitt (2000) comments that as part of understanding any innovation it is essential to understand “the people involved in its creation and use” (p. 66) as they are part of the way technological action occurs. So in technology, the third mode, technological activity, is
the technical knowledge that produces the artefact and the associated activity in using such artefacts.

A quintessential New Zealand food example in which ontology, technological activity and society are combined is the boil-up recipe. Puha (*Sonchus kirkii*), a New Zealand native sowthistle, can be regarded as either a weed or a food source. But by people applying scientific and society knowledge to distinguish between a puha and a dandelion, combined with the technological activity (of a person picking it, washing it, treating it before cooking it and cooking it), the puha plant is changed from a natural object into a technological artefact – a cultural New Zealand food dish – a delicacy known as puha with pork bones, colloquially known as boil-up, because of its cooking method.

The final mode is called *technological volition*. This is described as “the will that brings knowledge to bear on the physical world to design products, processes and systems” (Mitcham, 2001, p. 1). Mitcham (1994) suggests that human beings combine technological knowledge and volition with technological activity to produce technological objects. Consequently, *within human beings there is the will* to look at the elements of the item and transform it into a form that people want. This includes a vision of reality and the drive we possess to undertake these acts, and can include the appreciation of an ethical position and a person’s consideration of the aesthetics (de Vries & Dakars, 2009; A. Jones, Buntting, & de Vries, 2013; Mitcham, 1994).

With the boil-up example above, two types of volition are exhibited: firstly, by the makers of the dish applying technological volition by knowing that the plant is puha and that it can be turned into a food and, secondly, by wanting to make and eat that dish specifically to share with whānau (family).

Technology is defined in its broadest sense as human activity that transforms the natural environment to make it a better fit with the needs of humans (de Vries, 2005; McGinn, 1978). As Pitt (2000) suggests, technology “is humanity at work” (p. 11). This also supports the argument that the preparation, making and use of food slots neatly into this approach. It is argued in this thesis that food, whether from a plant, animal or synthetic/man-made source, is altered by humans for the deliberate intention of producing food for consumption. The views of Scharff and Dusek (2003) suggest that “technology’s proper role is mediating our relations with the natural world” (p. x). The world of food is richly sourced from the natural world, and through the harnessing of technological knowledge and volition, we undertake technological activity that produces a food technological artefact.
When viewing food from this broader technological stance, there is an opportunity to acknowledge how such an underpinning view of food technology could deepen and broaden a conceptualisation of food technology literacy. This aspect of food transformation and its influence on the individual, a population and the planet has a strong technological relevance.

In this thesis, it is proposed that a technological philosophical approach provides a way to conceptualise how food contexts can be analysed from a technological perspective. This analysis helps to identify the components of a food education model to develop technological literacy.

If food is the context, then studying how humans interact with food provides pertinent examples. Pitt’s (2000) comment that technology represents “the results of the systematic application of common sense; … and then knowledge by acting on that experience” (p. 91) shows that this concept can apply to humans, who, with will (volition), experiences of planning, design and trial, and the application of knowledge, produce a food outcome (artefact). The example of infant milk production is used in the following sections to provide an example of how knowledge, volition and technological activity can combine to produce such a technological outcome.

2.2.1 The process of infant milk production

This section outlines the ontological position that food is a technological artefact. This position is underpinned by Mitcham’s (1994) view of technology. When looking at milk from this perspective, one can explore this ontological position. This section will then examine the different modes of technology that Mitcham (1994) suggests, in order to support the argument that food is technological. De Vries (2005) defines technology as the “broad sense of the human activity that [can] transform the natural environment to make it fit better with human needs, thereby using various kinds of information and knowledge, various kinds of natural (materials, energy) and cultural resources (money, social relationships, etc.).” (p. 11). To illustrate this concept, the following argument identifies the technological knowledge relating to infant milk production.

The initial premise of this analysis is that human babies are vulnerable and need to be fed to stay healthy and alive. Initially, this problem is solved biologically by women having mammary glands that produce milk at the right formulation, temperature and sterility for the child’s needs. However, with modern lifestyles making different demands on women, such as the desire or need to work to create income, women are not necessarily able to breastfeed. With the
additional input of society’s increasing industrialisation, food manufacturers have been able to capitalise on this dilemma by producing a milk product substitute that will assist in meeting this need.

From a technological stance, this example provides an exemplification of Pitt’s (2000) suggestion of technological work in which the changing needs and goals of women have led to “the deliberate design and manufacture of the means to manipulate the environment” (pp. 30–31). In as much as there is a need to feed babies, there is also the desire of women to continue to work without the constraints of demand breastfeeding. So, industry has responded to this need and developed a milk product substitute. Consequently, a technological solution has been developed.

The process of developing this milk product substitute is complex. A wide range of skills and underpinning knowledge has fed into the design process. Functional modelling and prototyping have informed the decision-making that underpinned the development of the final product so it was fit for purpose. When unpicking the design brief, questions have been posed and answered – for example, what age group of babies is the milk product being developed for? An exploration of the nutritional needs of babies would be required so the product would be fit for purpose. The manufacturing lines of the formula once the formulation was determined would need to be sterile so no cross-contamination of the product could occur. How would the manufacturers market such a formula? What information would they need to provide? In what languages would the information need to be given? (Fonterra Co-operative Group, 2014c). These are just a few examples of the technological knowledge that would be applied (in technological activity) to ensure the designed artefact was fit for purpose.

There is also technological activity at the social and cultural level of society. The milk powder product may meet the needs and volition of the mother when she makes a choice to commence formula feeding. She also makes a product choice, perhaps based on the nutritional needs of her child. But there is also an interaction with wider society when the formula feeding commences. People other than the mother might be responsible for reconstituting and providing the formula to the baby (e.g., a crèche worker or a grandparent). They will need to make decisions about reconstituting the formula powder at the correct ratio and under sanitary conditions in order to make a milk that will meet the infant’s needs.

When one considers the world through a technological ontological perspective, then the production of milk formula reflects a broader view of requiring a solution to feed babies. For example, women with an alternative feeding regime available can make decisions regarding the
personal economics of returning to the workforce and not breastfeeding. A technological activity has been undertaken to produce an artefact that will fulfil a particular need. This example has illustrated that from the ultimate original food, naturally produced and perfectly formulated for human babies, humans have a deliberately designed technological substitute outcome.

To continue this analysis, if one considers food from a technological perspective, then Mitcham’s (1994) argument shows that food and food preparation (whether manufactured or domestic) can be interpreted this way, that is, by seeing the food artefacts that we make and use and looking within them to identify the technological knowledge, activity and volition that contributed to the production of that food item. However, there are other ontological perspectives from which food can be perceived, for example, the science of food and a food nutritionist’s perspective. The existence of these different ways in which food can be viewed has resulted in a disparity of approaches to how education for technological food literacy can be considered.

There have been attempts to breach this disparity, in particular, an attempt by food nutritionists and scientists to work together to develop a more comprehensive definition of food. The International Union of Nutritional Sciences and the World Health Policy Forum met at the University of Giessen in Germany in April 2005. The resulting Giessen Declaration explored the relationship between food and nutrition. The declaration tabled a directional change to the underpinning concepts of nutrition science, supposedly providing an international benchmark to underpin subsequent studies in the field of food (Cannon & Leitzman, 2006).

This thesis adopts the position that the group writing the Giessen Declaration (Beauman et al., 2005) came up with a way of expressing how food is perceived that approximates food technology more than nutrition. Consequently, Mitcham’s (1994) views of technology are applicable when considering this food context. Therefore, the central idea to this thesis is that a food technology literacy definition needs to acknowledge the various perspectives of food. The following analysis of the Giessen Declaration (Beauman et al., 2005) will show how these perspectives can be interpreted to give an even deeper understanding of how technological food literacy can be perceived and developed for a food technology literacy.

2.3 The Giessen Declaration

The Giessen Declaration explores the relationship between food and nutrition and provides an international commentary about the ideas of experts in the fields of food and nutrition (Beauman
et al., 2005). These experts proposed a conceptual framework that expresses a new definition of nutrition science. This forum and the resulting declaration are important to consider because it is hoped that they will provide a useful stance and a fresh, broader perspective for developing an education for 21st century food technology literacy.

The definition and purpose of the Giessen Declaration states:

Nutrition science is defined as the study of food systems, foods and drinks, and their nutrients and other constituents; and of the interactions within and between all relevant biological, social and environmental systems.

The purpose of nutrition science is to contribute to a world in which present and future generations fulfil their human potential, live in the best of health, and develop, sustain and enjoy an increasingly diverse human, living and physical environment.

Nutrition science should be the basis for food and nutrition policies. These should be designed to identify, create, conserve and protect rational, sustainable and equitable communal, national and global food systems, in order to sustain the health, well-being and integrity of humankind and also that of the living and physical worlds.

(Beauman et al., 2005, p. 786)

A key objective of the Giessen Declaration was to make nutrition science relevant for the 21st century (Beauman et al., 2005). Described by some of the members as a conceptual framework, it provides broader dimensions of nutrition science, indicating a three-dimensional perspective, that is, biological, social and environmental. As well, the dimensions are enlarged: “it is concerned with personal, population and planetary health; with the human, living and physical worlds” (Cannon & Leitzmann, 2006, p. 8).

As a consequence, the Giessen Declaration acknowledges the chemical and biological sciences that traditionally underpin food and nutrition, but it also shifts the focus from these narrow definitions of nutrition science to include a broader base that reflects how nutrition has wide-ranging effects in the modern world (Beauman et al., 2005).

Vidgen (2013), working from a nutritionist perspective, suggests that the Giessen Declaration 2005 could be a founding document that defines food literacy. This position could be useful to consider as this thesis also explores technological food literacy. However, the position of this thesis is that the Giessen Declaration’s view of food and nutrition is missing a link with humanity that would make it truly reflective of a technological outcome. This thesis asserts that human activity is central, and with human intervention and will (volition), food is created and should be considered a technological outcome.
As a consequence, this thesis posits that the philosophy of technology provides an anchor point for the Giessen Declaration to explain the transformative interactions humans have with food. It is argued that the Giessen Declaration suggests how the purpose of nutrition science contributes to personal, community and global levels but it does not suggest the mechanism by which this occurs. The researcher argues that the driving mechanism is provided through a philosophy of technology perspective in which humanity is at work. Scharff and Dusek’s (2003) phrase that “technology … provides us with a collection of instrumental means” (p. ix) identifies how a connection between the systems identified within the Giessen Declaration can be made with the driving mechanism of technology.

Mitcham (1994) suggests that “the rich complexity of the subject forces one to adopt at least a provisional classifying or categorizing scheme” (p. 154). If we look to the Giessen Declaration to provide this classification system for food technology, it could indicate that consideration should be given to the social, biological and environmental systems of food and their interactions with human, living and physical environments. Consequently, as Mitcham (1994) suggests, with knowledge, volition and activity, food as a technological object is created. The food issues that arise depend on the human context in which they are found.

2.4 The Giessen Declaration given a technological perspective

It will now be argued that the Giessen Declaration can be given a technological perspective if one wishes to develop technological food literacy. Consequently, aspects of technological knowledge (volition, activity and artefact) will be discussed in turn in the following sections, showing how the link between the Giessen Declaration and the philosophy of technology can occur and provide a deeper and broader view for food education. The sections will exemplify how the idea of a technological food literacy can be incorporated and how Mitcham’s (1994) four modes of the philosophy of technology can be utilised. Examples from each food system suggested by Giessen (biological, social and environmental) within each mode of the philosophy of technology (knowledge, volition, activity and artefact) are given. The technological food outcome of infant milk formula used previously will be used again as an exemplar to provide the context and illustrate the story. The purpose of the following section is to suggest that the Giessen Declaration can be utilised to reveal the depth and width of knowledge that can be harnessed when developing the concept of food literacy.

In an attempt to link the Giessen Declaration with Mitcham’s view that technological knowledge is developed within the domain of technology, this section will first examine different sorts of knowledge that the Giessen Declaration identifies as underpinning food. This
section will identify in particular the technological knowledge relating to infant milk formula. Because the Giessen Declaration identifies a range of systems connected with food, each system will then be explored in turn. These include the biological systems perspective, the social perspective and the environmental systems perspective.

2.4.1 Technological knowledge

Mitcham’s (1994) viewpoint of technological knowledge is that practical ideas and the making and using of artefacts create items that can be considered useful in the human world. Humans combine epistemology – the nature of technological knowledge – with the metaphysical approach, in which their vision of reality, ethical decisions and aesthetic judgements influence their actions (de Vries, 2005).

The Giessen Declaration (Beauman et al., 2005) identifies three food systems. The first is from the perspective of biological health. For example, biologists may know about the interaction of the milk formula in the human body, and so this will influence the formulation of the infant formula to be specifically structured to suit newborns, weaned babies or toddlers, all of which will require the nutrients in the milk in different proportions. The technologist is also concerned with biological health and will use all of these knowledge sources to focus it towards product development that is developing a functional food. The formulation of infant milk formula is covered by the Codex Alimentarius, which dictates an international food standard for infant formula (Food and Agricultural Organization of the United Nations, 1981). The biological dimension is deepened by this technological involvement, which dictates, among other nutrients, quite specific levels of protein, amino acids and vitamins that can be combined in infant milk formula product.

The second set of systems referenced in the Giessen Declaration (Beauman et al., 2005) is the social systems. A sociologist could be concerned about how cultural patterns influence food intake. This perspective focuses on how social systems can be influenced by technological knowledge, or in this scenario, the influences that create the social climate to support or create the need for this artefact. The artefact in this example is the reconstituted infant milk formula. With the use of infant formula instead of breastfeeding, family roles may change. Most people should be able to reconstitute the formula and bottle-feed an infant. Thus, the nurturing role is opened up to others, allowing the mother freedom to complete other roles, which might include her returning to paid work. The technological perspective enriches the potential to explore how social roles can be included in a discussion about technological food literacy.
The final set of systems that the Giessen Declaration (Beauman et al., 2005) refers to is environmental systems. An example of such systems in this context is that the basis of infant milk formula generally comes from dairy cows. There is an environmental cost to dairy farming as cows have an environmental impact; for example, the natural water tables running through farms can be polluted. Technological knowledge can be used to reduce the environmental impact of the cows by using proven knowledge of riparian planting and fencing off waterways that can improve the quality of natural water sources that run through dairy farms (Ministry for the Environment, n.d.) to minimise the impact of this intensive dairying land use. The use of an environmental viewpoint can provide a deeper understanding of technological food literacy – food is no longer just a product; it is an artefact that holds interrelated and interdependent relationships with other components in a system.

2.4.2 Technological volition

Mitcham’s (1994) modes of technology also include human will (volition). This is where knowledge about the physical world is used by humans to design products, processes and systems. These actions are related to people’s world view, and is also influenced by their ethical and aesthetical decisions (de Vries, 2005). This view of technological volition will be explained and examples will be given to illustrate when the biological, social and environmental systems are considered in the context of food.

The suggested volition for this scenario is the will that drives people to source an alternative artefact to human breast milk to feed infants. In the example of the infant milk formula, such volition may come from a biologically based decision that a mother may make about breastfeeding. A change to a breastfeeding routine may also be socially influenced. As a result, mothers make a personal decision to change feeding regimes and need to find an alternative solution that provides nutritional equivalency for the infant.

The social systems viewpoint may be focused on particular patterns of behaviour one might have around food – for example, humans may wish to develop the emotional bonds of contact of children via food. These bonds may be stronger with those who feed the infant, be it the mother or other family member.

An environmental perspective about cows and the pollution of waterways is an ethical dilemma faced by dairy farmers in New Zealand. Ethics is an aspect of technological volition and has a moral compass that involves people acting in an appropriate manner. The dairying industry has made an ethical decision that although the individual farmers collectively are part of a million-
dollar business that exports infant formula made from their cows’ milk, they also have an individual responsibility to minimise the effect of their dairy herds on the New Zealand environment. This decision can be seen by DairyNZ’s (n.d.) action to introduce a “Sustainable Dairying: Water Accord” (Environment, para. 9), which sets out “national good management practice benchmarks aimed at lifting environmental performance of dairy farms” (DairyNZ, n.d., Environment, para. 9).

If the ideas of the Giessen Declaration (Beauman et al., 2005) and Mitcham (1994) are combined, a deeper and broader contextualisation of technological food literacy is possible. Giessen’s conceptual frame that identifies these systems helps to identify and categorise how technology can intervene in the world of food.

2.4.3 Technological activities

Mitcham’s (1994) view of technological activity considers how many things “happen” in our world and the way in which technological knowledge underpins the production of artefacts. This section will identify technological activity relating to infant milk formula. Because the Giessen Declaration identifies a range of systems in which food interacts, each system will be explored in turn. These include the biological systems perspective; the social systems perspective, which could include the sociologist and the economist perspective; and the environmental systems perspective.

When one considers the Giessen Declaration (see Section 2.3) from a technology perspective, biological systems may be considered to identify the conditions under which milk formula is reconstituted, for example, if the formula is mixed in the correct proportions to provide appropriate levels of infant nutrition. Galtry (2013) comments that university researchers are allocated “grants to improve infant formula composition to better ‘emulate’ human breastmilk” (p. 87), which provides examples of the technological activity and volition that may lead to the development of an infant milk formula that has these particular characteristics.

Technological activity also involves the technical knowledge that produces the infant milk formula and the associated activities when using it. From the social perspective, it is relevant to recognise how the use of infant formula has become more socially acceptable than breastfeeding in some cultures and situations. However, the formula still needs to be reconstituted in a sterile manner, and stored safely. This technological activity needs to be conducted by someone, for example, the grandparents or child-minders, who are expected to use the correct measuring device and mixing system to reconstitute the feed in a fail-safe manner and feed the child with
the infant formula. This creates a different layer of social interaction between mothers, babies and caregivers.

The environmental systems approach can help identify technological activities. For example, the Fonterra Edgecumbe plant, which manufactures components from milk fat that are used in infant formula, maintains a 90% recycled materials policy (Fonterra Co-operative Group, 2014a), so there is active technological activity at reducing the waste production.

A synthesis of the Giessen Declaration systems and categories of human intervention (Beauman et al., 2005) is possible during this technological activity. This analysis helps to identify what may be important when educating for technological food literacy.

2.4.4 **Technological artefacts**

Technology in the general sense is about the making and using of artefacts (Mitcham, 2001). We are provided with information about technological objects by viewing what exists and is produced by “seeing” them through the technological framework (de Vries, 2005).

Infant formula is a technological object that can be viewed from many perspectives. The Giessen group’s identification of a biological system considers the nutritional needs of babies and considers a human artefact – infant milk formula – as its outcome. But systems are technological in nature as they are a “set of connected things” (Burchfield, 1986, p. 780) that work together. As a result, they have interrelated and interdependent elements.

If we view infant formula from the human biologist/nutritionist stance, then infant milk formula (from cow’s milk) is the material that is produced, used and manipulated to produce an infant formula to suit a particular nutritional need (Ministry for Primary Industries, 2012). These nutritionists might be interested in the problems that may surface if babies are undernourished; for example, if the infant formula is mixed incorrectly, nutrients may not be available in the correct amounts.

If science and food technology experts view infant formula as a technological outcome, then examples from the agricultural and food technology industries where the infant formula raw product is manufactured in a food-safe environment for a particular market could be considered. For example, Fonterra dictates a rigorous Hazard Analysis Critical Control Point System to their ingredient vendors to ensure the safety of their food products as they progress from pasture to baby’s bottle (Fonterra Co-operative Group, 2014b).
When examining how infant milk powder is used from a social systems perspective, this view may show how this artefact impacts ordinary peoples’ daily lives. For example, the use of infant formula could be viewed as a status item, demonstrating a higher disposable income (Galtry, 2013), because it could be an expensive purchase within the family grocery budget. One could also consider social norms about the role of women and their interactions with the feeding, and the social norm of who has responsibility for nurturing the youngest children in the family might be challenged.

When considering the infant milk powder artefact from an environmental perspective, the environmental cost of dairying could be explored. For example, in New Zealand, although considered an essential driver of the nation’s economy, the activity needs to take into account the impact it has on the natural environment, particularly the waterways. High productivity from pastures and high stock density on those pastures also mean high contaminant losses into fresh water supplies (Ministry for the Environment, n.d.).

Viewing the Giessen Declaration in some depth through a technological lens provides a way to look at technological food literacy in a manner that allows for many perspectives to be considered. The Giessen Declaration provides a broad classification system to the context of food and shows that we should consider the interrelationships of biological, social and environment systems when considering this context. If we then look again at these systems from a technological stance, we look deeper to understand the object, knowledge, activity and will that underpin the development of a food artefact. We are provided with a finer-grained method of analysis.

2.4.5 Summary of baby formula production

The first part of this literature review introduced the idea that food is a technological outcome and the researcher illustrated these ideas with the context of infant milk formula. Mitcham’s (1994) philosophy of technology provided a theoretical framework for explaining technological activity in which humans interact with food such as milk to transform it into technological outcomes such as infant formula.

To widen the dimensions of how this transformation of milk can be viewed and also to take into account other ways of considering milk, that is, from a biological, social and environmental perspective, this context of infant milk formula was used to show that one can examine the context from different perspectives. The purpose for this analysis was to provide some classifying criteria to underpin ideas about how a model for food technology literacy could look.
The idea that technological food literacy could have dimensions incorporating both the philosophy of technology and the Giessen Declaration was then explored, reusing the example of the technological product infant milk formula, all the while viewing the deeper aspects of a technology stance from a biological, social and environmental systems perspective. It would be useful to see this complexity as a visual model.

As this thesis is about technological food literacy in education, there needs to be a pathway to help technology teachers conceptualise how the food technological concepts can be identified and understood. De Vries (2005) argues that the philosophy of technology can “provide inspiration” for teachers about what “characterises technology itself” (p. 11) in terms of usefulness, functionality, physicality and design processes. The philosophy of technology has also been argued (in Section 2.2) as a way in which we theorise food from a technological perspective. At this stage, de Vries’s (2005) ideas about teaching technology will now be introduced and discussed, considering that educational opportunities and limitations may influence the underpinning concepts of a technological food literacy model.

2.5 The philosophy of technology in teaching about technology

It has been argued overall that a technology viewpoint embraces the complexity of food.

In current literature about technology education, it is also argued that the philosophy of technology should be expressed in curricula and should be used as a guide to inspire developments with technology education (Ankiewicz, 2015; Compton & Compton, 2011; A. Jones et al., 2013).

De Vries (2005), in particular, advocates for the teachers of technology to develop a perception of technology that is underpinned by the philosophy of technology. De Vries (2005) states that it would be difficult for teachers to “help other people acquire a good perception of technology in educational situations when one self does not hold a perception” (p. 10). He suggests that this perception is best underpinned by an understanding of Mitcham’s (1994) philosophical approach to technology. De Vries’s (2005) argument for adopting this underpinning philosophy in technology teaching practice includes a belief that having access to information about the philosophy of technology provides a reflective framework for teachers and inspiration for curriculum content, and supplies a conceptual base for understanding technology (p. 8).

Developing a characterising system and a concept of food that is underpinned by Mitcham’s (1994) philosophy of technology may help with identifying how food technology information could be included within a food technology literacy model. It may also help identify what
technological skills and knowledge relating to technological food literacy are important as well as how it differs from other subjects, thereby identifying what content and concepts need to be taught. It is hoped that such an analysis can provide guidance for teaching technological food literacy in a manner that makes sense to teachers.

A central idea of this thesis is that a food technology literacy definition needs to acknowledge the different perspectives of food that experts can have. Mitcham’s philosophy of technology can provide the space for this. The Giessen Declaration (Beauman et al., 2005) provides an identification of biological, social and environmental food systems that affect the individual, population and global perspectives. In doing so, the Giessen Declaration (Beauman et al., 2005) could frame some categories that food experts have identified, and this may be interesting to consider. It is argued that the philosophy of technology provides a mechanism to characterise the effect of human activity during technological activities. Technology knowledge and volition provide the driving force to produce technological food outcomes that can be categorised by the broad categories of personal, population and global effects that the Giessen Declaration (Beauman et al., 2005) identified.

To understand the rich complexity that the context of food brings to technology education, there needs to be an underpinning philosophy that embraces all of the possible dimensions of food. A philosophy also needs to be able to be translated into educational practice so that students engaging in food education are supported and given space to develop a rich food literacy. It is asserted that the philosophy of technology provides this broad conceptual base from which food can be examined and characterised.

The second part of this literature review argues that the philosophy of technology should underpin technology teaching, referencing the ideas of de Vries (2005), A. Jones et al. (2013) and Compton and Compton (2011). However, as this thesis is about technological food literacy, there needs to be a review of the ideas about food literacy and food education. It has been indicated by Vidgen (2013) that the idea of food literacy is a relatively young term. However, as definitions of food literacy do exist, it is relevant that these are reviewed, particularly to see whether they have any relevance to the Giessen Declaration (Beauman et al., 2005). Likewise, the idea of food education. Although food education has been present in school curricula since the 1840s (Owen-Jackson & Rutland, 2016), there does not appear to be any common theoretical thread. Consequently, the next section will identify and critique definitions of food literacy and the approaches to food education that are in use in order to show their potential strengths or inadequacies when defining technological food literacy.
2.6 Definitions of food literacy

This literature review anticipates that to appreciate the complexities of food literacy there needs to be a link between a food literacy definition and the underpinning dimensions of the Giessen Declaration (Beauman et al., 2005). The following review of organisations using food literacy definitions is intended to build a case for food literacy education occurring on a global scale. It is intended that this discussion will identify different groups and the drivers that underpin their approach to developing food literacy.

A literature search was undertaken to identify definitions of food literacy. The criterion for such a web search was the term “food literacy”. This search identified educational programmes that indicated in their descriptors that they taught, promoted or inspired people to develop food literacy. One research project was found.

For reader ease, the following definitions are categorised into global regions: the United States, the United Kingdom and Europe, and finally, the Asia-Pacific region.

2.6.1 Food literacy definitions from the United States

The Food Literacy Project provides a societal focus for students living and using the Harvard University food services on campus and aims to “cultivate(s) an understanding of food from the ground up” (Harvard University Center for the Environment, n.d., para. 1). They describe the project goal as promoting “enduring knowledge enabling consumers to make informed food choices” (Harvard University Center for the Environment, n.d., para. 1).

The Californian Food Literacy Center (2015) provides a focused definition of food literacy as “understanding the impact of your food choices on your health, the environment and our community” (Our Mission and History section, para. 6). They deliver an educational package to a target audience of low-income elementary-level children, encouraging them to eat their vegetables by teaching them cooking and nutrition.

The Food Literacy Project (2016) in Kentucky services a rural-based population and provides a “farm-based experiential education” alongside “entrepreneurial youth development programs” (About section, para. 1). Their definition of food literacy is “to inspire a new generation to build healthy relationships with food, farming and the land” (Food Literacy Project, 2016).

The Nourish programme is run within a National Park in the San Francisco area. With particular reference to a “farm to table” approach, this programme appears to have a similar emphasis to the Food Literacy Project run in Kentucky and defines food literacy as “understanding the story
of one’s food, from farm to table and back to the soil; the knowledge and ability to make informed choices that support one’s health, community and the environment” (Nourish, 2016, Food Literacy Quiz section, para.1)

In summary, it appears that an important aspect of food literacy programmes in the United States is the biological dimension, which relates to health and nutrition. Another focus of the programmes appears to be a consideration for participants to understand the big picture ideas about where their food comes from, the environment they live in (environmental dimension) and how this may contribute to a sense of community (social dimension). Such definitions reflect food literacy viewed from a personal context.

2.6.2 Food literacy definitions from the United Kingdom and Europe

The British and Scottish definitions have many similarities in that they both attempt to look at nutrition and food production with the aim to increase social awareness of these topics. The Green Food Project is based in Britain. Their definition of food literacy is described as “consumer understanding, awareness of and engagement with food including where it comes from, how it is grown and the socio-economic and environmental impacts associated with the food we buy and choose to eat” (Defra, 2012, p. 1). It references consumers’ involvement with their food supply and encourages a level of social awareness about the impacts of the food people choose to buy and eat.

The Royal Highland Education Trust (2016) “aims to make children in Scotland food literate – to understand about agriculture, the community value of food, food preparation and nutrition” (Experiential learning section). This programme provides experiential learning opportunities with a focus on the science and technological, sociological and biological dimensions.

The Food Literacy Organisation, based in Europe, provides a definition of food literacy as “the ability to organise one’s everyday nutrition in a self-determined, responsible and enjoyable way” (Food Literacy Center, 2015). This organisation works with adult educators, teaching about food, its origins and how to prepare a “proper” meal so they can then pass on this information to the adults who have not received this food knowledge from their own home or schooling backgrounds (Food Literacy Center, 2015).

In summary, the United Kingdom has a primary focus on an industrial level, considering how environmental improvements can be achieved and how food production can be influenced rather than a single focus on food education. Such definitions show food literacy situated within an
industrial context rather than from a broader technological perspective. The European definition focuses on nutrition and cultural food habits, with food literacy situated in a personal context.

2.6.3 Food literacy definitions from Asia-Pacific

The definitions from the Asia-Pacific countries were also discovered with the Google search of “food literacy”. On closer inspection, these organisations define nutritional literacy in their documentation rather than food literacy. For purposes of completeness, the definitions are included in this section as they may clarify this analysis of food literacy because nutrition is part of the food landscape and may link to aspects of the Giessen Declaration (Beauman et al., 2005).

Food Industry Asia (FIA, 2016) refers to nutritional literacy, identifying this as “equipping communities with the nutritional literacy they need to make good decisions, as well as the food resources and security they require to survive and thrive”. There is particular reference to offering adequate nutrition, especially for schools and children (FIA, 2016). Increasing access to clean drinking water is also recognised as a key concern to be addressed (FIA, 2016). This indicates a strong link with the biological dimension as well as the economic dimension.

The Asia Round Table on Food Innovation for Improved Nutrition (ARoFIIN, 2015) is a partnership between government, academia, industry and civil society around Asia to develop science-based solutions to the health challenges in the region (About us). ARoFIIN seeks to address South-East Asia’s public health and nutrition challenges through partnerships and innovation in a home-grown way by solving problems using the resources they have in their own region. Working to raise the quality of nutrition education in Asia, they identify with a goal to “make healthy eating more appealing, make healthy food a popular choice” (ARoFIIN, 2015). This links directly to the biological dimension of the Giessen Declaration.

Nutrition Month Malaysia (NMM) is a collaborative programme managed by professional bodies who founded the idea and the Malaysian Ministry of Health. Every April (since 2002) there is a themed month of nutrition-focused activities that link with their definition of food literacy of “healthy eating and active living” (Nutrition Month Malaysia [NMM], n.d.). The ideas link strongly to the biological dimension with topics such as “healthy eating, healthy life”, “youth and nutrition” and “healthy children, healthier nation” (NMM, n.d., History, para. 4).

Vidgen’s work is important to consider as she sought to define food literacy in Australia. Vidgen and Gallegos’s (2012) work investigated the term food literacy in a case-study situation with particular reference to food literacy in the nutrition of a group of Australian 16–25 year
olds who were living in social exclusion and poverty. Embedded within the health literacy matrix and using the social determinants of health as overarching principles, this work reflects on the role of individuals’ existing food literacy and how a food literacy awareness may influence individuals’ health status by enabling them to eat healthily. Vidgen and Gallegos (2012) define food literacy as:

A collection of inter-related knowledge, skills and behaviours required to plan, manage, select, prepare and eat foods to meet needs and determine food intake. Food literacy is the scaffolding that empowers individuals, households, communities or nations to protect diet quality through change, and support dietary resilience over time. (p. vii)

Vidgen and Gallegos’s (2012) work suggests that food literacy is how individuals’ behaviour is scaffolded so they are enabled to choose appropriate food that will meet their nutritional needs. When reflecting on core components of food literacy, they suggest that they are linked with a personal context rather than being a “universal set of competencies that can be applied in all settings” (Vidgen & Gallegos, 2012, p. 161).

The focus of this thesis is within the secondary school environment and the food education curriculum, which Vigden and Gallegos’s (2012) work did not research. Their definition provides strong links to the sociological and biological dimensions. This research signals a belief that food literacy needs to consider more perspectives about food as suggested by the Giessen Declaration.

In summary, the Asia-Pacific region has a primary focus on dietary choice and quality. These definitions all appear to focus on developing health outcomes and nutritional education for their participants. Definitions of this nature show food literacy in biological contexts rather than from a broad technological perspective.

2.6.4 **Summary of food literacy definitions**

It appears there is no common underpinning definition of food literacy. In particular, there appears to be no food literacy definition in the New Zealand context. It seems that the Giessen Declaration (Beauman et al., 2005) can contribute to a definition of food literacy. However, the view of this thesis is that a food literacy definition needs to not only consider the Giessen Declaration (Beauman et al., 2005) but also incorporate the views of the philosophy of technology (de Vries, 2005; Mitcham, 1994). As a result, this researcher feels that a word definition could be too complex for future analysis. A more accessible view of portraying this complex definition in this thesis could be through the use of a model that shows this complexity.
A model is able to reflect a versatility and an adaptability, as well as being able to be contextualised in many different formats.

When comparing the definitions of food literacy from around the world against the yardstick of the Giessen Declaration, the biological dimension of food provides a common approach to describing this concept. In some instances, the social dimension is also considered; however, the environmental system is largely ignored.

Therefore, it appears that an overall view of food literacy is not expressed with these food literacy definitions and the supporting educational programmes. Likewise, it appears that New Zealand does not have a food literacy definition or an education programme styled to achieve it. In order to support the rich complexity of food, it is suggested that education needs an underpinning philosophy that embraces all of the possible dimensions of food as identified in the Giessen Declaration.

Food education is taught in schools. At this stage of this literature review, the intention is to critique food education in schools in order to identify the underpinning philosophy and approach to see how food literacy is characterised.

2.7 Formal food technology education curricula

To support the rich complexity of food as a concept, it is proposed that education needs an underpinning philosophy that embraces all possible dimensions of food. Such a philosophy needs to be able to be translated into educational practice so students engaging in food education are supported and given space to develop a rich awareness and understanding of food literacy. This literature review has shown that the philosophy of technology can provide a broad conceptual base from which to examine and characterise food and it has the capacity to encompass all of the components that have been identified in the Giessen Declaration.

To fully understand the potential of the rich complexity of food literacy and how education in food is conducted, it would be useful to see how food is expressed in curricula from around the world to see how food concepts are presented to educators. The original argument in this thesis is that the philosophy of technology viewpoint embraces the complexity of food and its many dimensions. It now seems pertinent to investigate whether the philosophy of technology is reflected in food education curricula. It could be argued that if space is provided in food curricula in a manner that permits the expression of the philosophy of technology, then space provided for the rich complexity of food could also be considered. This investigation also provides the opportunity to discover whether suggestions have been made about what
knowledge is considered appropriate in a food curriculum and to consider how this knowledge may influence teacher pedagogy.

For some countries, the technology curricula indicate that their food technology education is not underpinned by the four philosophical tenets of technology – artefacts, knowledge, activity and characteristics of humanities. These countries have been excluded from this critique. Some countries do appear to underpin their food technology curricula with the philosophy of technology, namely, England, New Zealand and Australia, the latter in the new Australian Curriculum, Assessment and Reporting Authority (ACARA) curriculum. While not explicitly expressed, this viewpoint was gained by reading within the teaching support material.

In arguing for the philosophy of technology to underpin educational practice when food is the focus, it is important to understand how the philosophy of technology is expressed in curriculum documents, particularly technology, where food can be used as a context. These curricula will now be explored.

2.7.1.1 Food technology education in England

Rutland and Owen-Jackson (2015b) state that the National Curriculum in England requires students to learn cooking and nutrition. They indicate that the National Curriculum implemented in 2014 requires students to “develop creativity and imagination, risk-taking and technical expertise and to learn about modern materials and technologies” (Rutland & Owen-Jackson, 2015a, p. 471) but this is often conducted in foods classrooms that are equipped with domestic-style appliances, and the students are provided with limited opportunities to design food products from the conceptualisation stage through to marketing ideas (Rutland & Owen-Jackson, 2015a). The new curriculum also suggests that students should learn nutrition principles and how to cook; however, it does not marry this within food technology, but has it as a separate section in the design and technologies section (Rutland & Owen-Jackson, 2015a, p. 472). The learning ideas suggested in the National Curriculum indicate that learning situations are to be provided that allow students to understand and apply health and nutrition principles, give them opportunities to cook savoury dishes that contribute to a healthy and varied diet, and enable them to become competent in a range of cooking techniques and to understand a broad range of ingredients (Rutland & Owen-Jackson, 2015a). It appears that students may develop some knowledge of technological food artefacts and technological knowledge as they are given some practical opportunities to work with food. However, learning opportunities in which they undertake technological activity to make something happen, driven by their own technological volition, appear to be limited.
However, Rutland and Owen-Jackson (2015a) do provide a conceptual framework that describes food technology as a subject in schools in which designing and making food products occurs. They suggest that their conceptual frame would provide meaningful and authentic learning opportunities in food to “engage and motivate” (Rutland & Owen-Jackson, 2015a, p. 480). This framework suggests that students engage with a design and make process with food, covering topics such as new food technologies, the science of food, cooking and nutrition, and the sustainability of the food supply chain at a local, national and global level, and develop an appreciation for the regulatory environment surrounding food and the role consumers play (Rutland & Owen-Jackson, 2015b).

2.7.1.2 Food technology education in New Zealand

In New Zealand, food technology is identified as a technological area and a processing technology within the technology curriculum (Ministry of Education, 2007). Technology is regarded as a designed intervention (Ministry of Education, 2007). There are three aspects that inform teaching practice. In the technological knowledge strand, students explore how and why things work. Functional modelling is used to explore material properties and to test and evaluate design ideas (Ministry of Education, 2007). In technological practice, the ideals of planning for practice, developing a brief, and developing and evaluating an outcome are applied (Ministry of Education, 2007). Within the nature of technology strand, a critical analysis of technology is expected. Students are required to learn how technology can intervene in their world and what impact this may have from a social and an environmental perspective (Ministry of Education, 2007).

The technology curriculum in New Zealand uses generic statements. There is limited indication as to what could contribute to subject knowledge in the foods classroom.

2.7.1.3 Food technology education in Australia

In recent years, Australia has been developing a nationally based curriculum through ACARA. This curriculum is being introduced throughout the different states of Australia in 2016–2017. In 2017, two versions of the Australian curriculum exist and are in use (Australian Curriculum, Assessment and Reporting Authority [ACARA], n.d.-a, Australian Curriculum pop up screen). Version 7.5 was selected for analysis in this section. It is worth noting that Vidgen’s research mentioned in Section 2.6.3 is not considered in this analysis. Her research documents a qualitative study of young disadvantaged people who were responsible for feeding themselves. The purpose of Vidgen’s study was to explore the knowledge, skills and behaviours they used in their daily eating and did not investigate food education curricula (Vidgen & Gallegos, 2012).
Food is a context in the design and technologies curriculum in Australia. In the knowledge and understanding strand, the characteristics and properties of designed solutions are explored and evaluated. It is suggested that investigations into properties of materials and how they influence the designed product be carried out (ACARA, 2011). The processes and production strand indicate that the students should investigate, plan, design, manage, create and evaluate solutions to authentic problems (ACARA, 2011). Suggested topics include investigating how technologies can contribute to societies and the effects brought to bear on equity, ethics, personal and social values, and the future and sustainable patterns of living (ACARA, 2011).

The design and technology curriculum strands provides indicators to teachers as to what could contribute to the subject knowledge in the food context. For example, a content description that is provided for Years 7 and 8 design and technologies suggests that students should “analyse how characteristics and properties of food determine preparation techniques and presentation when designing solutions for healthy eating” and elaborate this with an example of investigating the “relationship between food preparation techniques and the impact on nutrient value, for example steaming vegetables” (ACARA, n.d.-b, ACTDEK033 section).

2.7.2 Summary

From these brief summaries, it appears that England’s, New Zealand’s and Australia’s curricula underpin their food technology curricula with some aspects of a philosophy of technology (see Section 2.2). It is interesting to note that England and Australia indicate some subject-specific knowledges that should be taught that are provided in supporting textbooks or in the curriculum documents themselves. Not all the components of the philosophy of technology are overtly expressed. It is reasonable to conclude that identifying components of a technological food literacy that are referenced to the New Zealand technology curriculum is possible and is worthy of continued investigation.

A first step in identifying relevant knowledge is to consider any research conducted in food technology education to inform this project. One research project that considers the efficacy and appropriateness of food technology education is a project conducted by Rutland and Owen-Jackson (2015a). This research will now be reviewed.

2.8 A conceptual frame for modern food technology

Rutland and Owen-Jackson (2015a) aimed to develop a conceptual frame for modern food curricula. They undertook this by initially hearing from stakeholders they felt held a position of relevance to food education. Based on this information, a conceptual frame was developed and
this was compared with existing school schemes of work and exam specifications. Finally, teachers and pupils of food technology were surveyed about their experiences of teaching and learning in food technology.

Rutland and Owen-Jackson’s (2015a) conceptual frame for modern food technology education included:

a) designing and making food products;

b) an underpinning of science of food, cooking and nutrition;

c) exploring existing, new and emerging food technologies in a context of sustainable development of food supplies locally, nationally and globally;

d) an appreciation of the role of consumers, the food industry and government agencies in regulating the food environments. (p. 472)

When this conceptual framework was used to explore current food schemes of work and examinations, it was found that food technology teachers were constrained by their own knowledge of food education. Time was a constraint for practical lessons, as was the student requirement to provide ingredients. This meant that often only basic food products were created. Learning in food technology was seen as equipping students with a life skill, and a way of tackling the obesity issue that confronts most western countries (Rutland & Owen-Jackson, 2015a).

Rutland and Owen-Jackson’s concluding remarks suggest that food technology is not seen as an academic subject. To remedy this, they suggested engaging students with higher-order thinking skills, particularly by experimenting with food. Rutland and Owen-Jackson (2015a) also suggested that food technology should be taught in combination with sciences, to nurture a deeper level of understanding about food. They felt that food technology lessons could explore modern food materials, accessibility and production, and that teaching should link with food employment opportunities. Finally, they urged schools to consider extending the practical opportunities provided to develop greater skill depth (Rutland & Owen-Jackson, 2015a).

As this research is based in New Zealand, it seems pertinent to consider developing a model to teach food literacy education for a New Zealand context that could be adapted internationally. As this thesis posits that a food literacy definition needs to consider both the Giessen Declaration (Beauman et al., 2005) and the views of the philosophy of technology (de Vries, 2005; Mitcham, 1994), it has been proposed that a more accessible view could be through the use of a model that shows this complexity (see Section 2.6.4). Therefore, a question in this
research emerging from the literature review is *How can food literacy be expressed for education?*

### 2.9 Learning theory underpinning education

This section will review the evolving nature of the curriculum in New Zealand technology education and highlight the learning theories that have been expressed as underpinning it. It is important to consider those learning theories that are perceived as contributing to effective learning in technology. This is because they may contribute to effective learning and pedagogy for a food literacy education programme.

As this research is based in New Zealand, the learning theory that informs *The New Zealand Curriculum* (Ministry of Education, 2007) has been contextualised and critiqued because this informs the pedagogy that was investigated.

#### 2.9.1 The New Zealand Curriculum

A curriculum sets the “direction for learning” (Rutherford, 2005). Technology is one of the eight essential learning areas within *The New Zealand Curriculum* (Ministry of Education, 2007). In recent years, the New Zealand curriculum has been reviewed and rewritten. During 2001-02 the New Zealand curriculum was reviewed. The New Zealand Stocktake report investigated how teachers interpreted and implemented the curriculum and made recommendations that sought to better support teachers and schools (Ministry of Education, 2001). The following New Zealand Curriculum Matauranga Project then sought to review and refine all the curricula taught under the New Zealand curriculum education umbrella (Bolstad, 2004). An outcome was that *The New Zealand Curriculum* (Ministry of Education, 2007) was rewritten, creating less detailed and specific documentation than past curricula and examination-focused syllabi, and with a focus on developing “process oriented outcome based documents” (Compton & Compton, 2011, p. 192).

*The New Zealand Curriculum* (Ministry of Education, 2007) is a curriculum based on constructivist learning theory in which knowledge is “presented as a social construct … developed by and inseparable from the ‘knower’” (Compton & Compton, 2011, p. 192). Learning within the constructivist view assumes that students’ knowledge is “individually constructed and socially co-constructed by learners based on their interpretations of experiences in the world” (Jonassen, 2009, p. 217). Constructivist learning has links with the theories of Bruner and vygotksy (Cranton & Taylor, 2012, p. 195) in which students construct their understandings through personal experiences. When new ideas are encountered, students are considered active learners, reconciling their original ideas with the new knowledge, who have
the potential to change what they know or believe while developing new knowledge. Implicit in this idea is that learning is gained from action and interaction with people (Vygotsky, 1962). As a result, others are involved in the learning process so learning has the potential to be experiential, practical and transformative.

In the 2000’s there was ongoing research into curriculum that informed the educational practice in New Zealand schools. However, there was a difference between the underpinning theoretical frames informing the overall curriculum research and the research informing the emerging technology curriculum in New Zealand.

*Technology in the New Zealand Curriculum* (Ministry of Education, 1995) documentation was redeveloped at a similar time within the overall curriculum review project and introduced additional and strengthened the definitions of curriculum strands within the *Technology in the New Zealand Curriculum*. However, this technology curriculum development was informed by sociocultural theories of learning. At the time, models of learning such as situated cognition (Brown, Collins, & Duguid, 1989) and communities of practice (Lave & Wenger, 1991) provided the background to research and teacher learning in technology education in New Zealand.

This created a tension as constructivism focused on the identification of broad outcomes for the learner and the teacher within *The New Zealand Curriculum* (Ministry of Education, 2007), whereas the sociocultural perspective informed the technology section (Ministry of Education, 2007), where learning was viewed as a transformative interaction and so future learning outcomes could not be identified prior to teaching (Compton & Compton, 2011; Schunk, 2012).

Compton and Compton (2011) indicate that the difference in theoretical positions creates different ideas on how students’ progress is visualised. For constructivists, thinking happens in the mind rather than through interactions with people, but for socioculturalists, educational experiences are framed in a contextual, authentic learning environment being utilised for their students based on interactions with people. A constructivist-oriented national curriculum provided the big ideas around which each learning area could focus its practice, whereas the sociocultural perspective focused on the student developing a “holistic competence or ‘literacy’ in a learning area” (Compton & Compton, 2011, p. 193).

Rather than providing a tension or negative position, Compton and Compton (2011) argue that a constructivist curriculum provides direction for technology programmes in terms of underlying support structures such as ideas, values and beliefs. The curriculum is then in turn supported by
sociocultural learning ideals that enact a relationship with appropriate communities of practice. However, the anchoring ideas about food are not articulated in The New Zealand Curriculum (Ministry of Education, 2007). It would be useful to see how these perspectives are unpacked and implemented in practice in the school and the pedagogical strategies that could be applied.

2.9.1.1 Sociocultural learning theory

Sociocultural learning theory is based on Leo Vygotsky’s (1962) findings that learning is transformed and transferred by social interactions and speech. Vygotsky theorised that higher-order thinking activities are developed within the activities that humans do, leading to the invention of items (artefacts, tools and speech) that transform people’s lives (Vygotsky, 1962). By communicating about such technology, social interactions occur and learned behaviours develop. People develop new skills and actions as they interact with their world. For students in the classroom, this could take the form of applying critical thinking skills to solving problems or responding by developing their practical skill base further when creating an artefact as a solution. This socially oriented perspective about how humans learn provides a futures perspective for technology curricula and students in which the past and future are considered and acted upon in the present (Fleer, 2015). By association, this means that others are involved in the learning process.

Vygotsky’s work has influenced that of others, such as Barbara Rogoff’s work on apprenticeship in thinking and Jean Lave’s work on communities of practice – work that in turn has backgrounded much of the research in technology education (Fleer, 2015). These concepts have helped provide ideas about teaching practice in technology education. The main implication of technology education that is based on the philosophy of sociocultural learning theory is that technology education must provide opportunities for students to learn through experiences. These ideas of providing experiences for students have been focused on because they have some level of authenticity embedded within them as a way to develop realistic learning opportunities.

2.9.1.2 Authenticity

The most recent curriculum development in New Zealand encourages teachers to provide authentic learning opportunities for their students, in a manner that provides an insight into technologists’ technological practice (Compton & France, 2012; Ministry of Education, 2007). The theoretical underpinnings of sociocultural learning theory provides some reasoning for authenticity in learning activities to be provided. Wenger (1998) has argued that learning is a social activity, and as such, an active engagement with the world is needed to produce meaning
from the knowledge that is gained. Hennessey and Murphy (1999) suggest that authentic classroom practice should be based on situations that are relevant to and real in students’ lives and in which they might find themselves in the future (p. 15).

Turnbull (2002) also suggests that a link between teaching programmes and the real world must be established. Furthermore, with reference to the New Zealand education scene, Turnbull suggests that technological activities provided to the learner should be authentic, and that technological programmes should be developed with an emphasis on authentic practice and culture (Snape & Fox-Turnbull, 2013; Turnbull, 2002).

Depending on which learning theories are drawn upon, different values about the knowledge communicated can be expressed (McCormick, 2006). If food education is taught within the technology curricula, there is a suggestion that learning will be experiential. There are several learning theories that explain learning through experiences:

- situated cognition
- communities of practice
- experiential learning

and appear to be most appropriate to food education. These theories are underpinned by the idea that learning through experiences is an interactive socially based activity. It is suggested that practical learning experiences are linked to the development of knowledge and ideas about concepts and understanding in technology education (Lewis, 2005; McCormick, 2004; Middleton 2005). It is proposed that these learning theories help conceptualise technology education pedagogy and how everyday practices and concepts can be taught.

2.9.1.3 Situated cognition theory

Situated cognition is based on Vygotsky’s (1978) learning theory and these concepts were linked to the classroom by Brown, Collins and Duguid (1989). A situated cognition view of learning suggests that “knowledge is situated, being in part a product of the activity, context and culture in which it is developed and used” (Brown, Collins, & Duguid, 1989, p. 32). This theory suggests that knowledge is gained through practical participation and is contextualised within certain groups of people. Technology education is strongly contextualised. An experience or activity in context frames the knowledge being learned and the social interaction that occurs is critical to situated learning development. The context is important to consider as it has the particular culture and associated values of the community of practice (CoP) attached to it, which the student learned by their contact and involvement. Using this theoretical approach, students
are exposed to their attitudes, beliefs and behaviours, and as a result, observe a variety of knowledge forms being enacted. This approach to learning emphasises the need for teacher’s pedagogy to reflect, develop and create space for students to become active participants in authentic learning environments where they can observe and develop these skills.

2.9.1.4 Communities of practice

Lave (1988) proposed that learning occurs through participation in a CoP. Lave’s (1988) ideas resulted after research work in which he observed the transfer of tailoring skills between skilled craftsmen and their apprentices. Lave (1988) argued that this social interaction in a CoP was critical for situated learning to occur. This was considered an active participation, in which the apprentices were provided with an authentic context in which they could learn and develop conceptual understandings and skill mastery by being involved in the interaction alongside members of that CoP. As the apprentices developed in confidence and mastery of a skill, they moved from the periphery or outer circle of the CoP to developing legitimate peripheral participation, through which the apprentices and masters developed common bonds of interconnectedness based on skills, activities and knowledge. This viewpoint helps to explain how we learn in the real world versus how we learn in the school classroom environment (Resnick, 1987), where passive learning and rote repetition of skills and concepts may be teaching tools that do not engender transference of knowledge and are not indicative of true learning. Consequently, the apprenticeship style of learning reflects a base of social interaction and context-driven nature of learning that is evident in food technology education.

2.9.1.5 Experiential learning

Experiential learning focuses on the learning process carried out by the individual. Experiential learning follows a belief that learners should be involved as much as possible in the learning process, using as many of their own skills and abilities as possible in the process, and is underpinned by the idea that student involvement is maximised if it includes something that matters to them (Crosby, 1995). Experiential learning holds a strong practical focus, which also holds true in food technology education classrooms.

Kolb illustrated how experiential learning can be set up with a four-step experiential learning model in which learning is a making meaning process that moves students through a four-step process (Loo, 2002). In the first step, students are moved to being exposed to a real experience that sets the scene and then, as the second step, is seen to provide the learner with an opportunity to experience the situation in the present. These two stages are followed by a third step, a reflective phase when considerations are made about what is successful and what is not, and
students are asked to think about ways that the situation could be improved upon. Finally, as the fourth step, the reflective actions are enacted by active experimentation (Kolb, 1984). To set the learning in action, Kolb (1984) states that for students to develop genuine knowledge from experiential education, they must first display certain learning characteristics (p. 21). It is expected that learners be prepared to be actively involved and reflective in their learning, be able to use analytical skills to conceptualise the experience, and demonstrate decision-making and problem-solving skills so as to use the new ideas gained from the experience. These expectations of students’ behaviour may be significant to consider when teachers are developing a technological food literacy activity for their students.

A key focus for this research is the investigation of the implications for providing technological food literacy education for 21st century students by understanding how these three learning theories can enable the researcher to interpret how the teaching and learning of food literacy may occur in the classroom through the teacher enacting this amalgam of learning theories.

2.10 Pedagogical content knowledge

Technology teachers often train as specialists in particular subject fields prior to becoming teachers. As a result, they bring subject-specific knowledge that can influence their classroom practice. The combination of this subject-specific knowledge and the teacher training on how to deliver such knowledge in the classroom is referred to as pedagogical content knowledge (PCK) (Shulman, 1986).

PCK offers a framework to analyse the learning experiences that teachers scaffold for their students and bridges the gap between content knowledge and the practice of teaching (Ball, Thames, & Phelps, 2008). Shulman (1987) suggested that PCK devolves into seven key categories: general pedagogical knowledge to do with classroom management; knowledge of learners and their characteristics; knowledge of educational contexts from the classroom to the character of governance and communities; knowledge of the aims and purposes of education; content knowledge; curriculum knowledge that provides the tools of the trade; and PCK, the blend of content and pedagogy that creates teachers’ professional understandings (p. 8).

Cochran, DeRuiter and King (1993) provided a modified perspective of PCK, based on a constructivist view of learning (p. 265). Their version of PCK, PCKg, which stands for pedagogical content “knowing” rather than “knowledge” (Cochran et al., 1993, p. 266), takes into account a more active, dynamic idea of continual learning about teaching, emphasising
knowing as a continual, ongoing development of the teacher, as opposed to Shulman’s (1986) idea of knowledge, which suggests a more static idea of knowledge gained and utilised.

There has been limited but focused research on PCK in technology education in New Zealand. Firstly, A. Jones and Moreland (2004) provided a framework for planning that identified the components of practice in primary schoolteachers’ technology programmes. Focusing on existing teacher practice, A. Jones and Moreland (2004) identified key aspects of a teacher’s pedagogy in technology. Teachers were then scaffolded to develop key components of practice on a planning framework that reflected the ideals of the technology curriculum (Ministry of Education, 1995).

Another pedagogical framework developed at a similar time was the technology assessment framework (Compton & Harwood, 2003). This was a model that interlinked student activities with elements of technological practice to develop a map of appropriate technological practice for students (Compton & Harwood, 2003). These components of practice were regarded as the generic concepts of technological practice throughout different contexts, and they could then be used to plan and assess students’ progress as allied to the curriculum (Ministry of Education, 1995).

The main focus of Technology in the New Zealand Curriculum (Ministry of Education, 1995) was highlighting technological practice as a context and the authenticity of its classroom implementation. However, upon reflection, there was a sense that this curriculum operated without much consideration for the wider impact that technology had upon our communities and the country, or even a consideration of any global impacts. There was an attempt to correct this position with the introduction of additional technology curriculum strands in the superseding The New Zealand Curriculum (Ministry of Education, 2007). To date, there appears to be no research on New Zealand technology teachers PCK that links to The New Zealand Curriculum (Ministry of Education, 2007). Snape and Fox-Turnbull (2013) challenge New Zealand technology teachers to “critically reflect on their role and their idea of what defines ‘best practice’ for teaching and learning in the twenty-first century” (p. 51) in order to meet the intentions of The New Zealand Curriculum (Ministry of Education, 2007). There is the opportunity to investigate the pedagogy that reflects the sociocultural learning ideas, values and beliefs that underpin the technology curriculum.

Mioduser (2015) reflects on the need for technology education to develop effective pedagogical models that consider the technological changes that are occurring at a rapid pace in our world.
outside of teaching, as well as the different definitions of technology education and the perspectives about the nature of technology education that these definitions generate.

He suggests that teaching and learning in technology education is a complex system with many interacting factors that affect the learning process. These factors are “learners, teachers, content, pedagogical means, sociocultural realities, value systems, educational goals, labour-market expectations, organisational characteristics and institutions” (Mioduser, 2015, p. 96) and he suggests there are potentially more than those that he has listed.

However, Mioduser (2015) indicates certain consensus ideas exist about what an effective technology pedagogy should incorporate, irrespective of differences of an underpinning technology philosophy, the culture and society where the education is conducted and the emerging technologies still to be invented. These ideas are:

- that learners should be actively involved in design and problem-solving processes
- that pedagogical goals need to be defined to enable students to master cognitive and metacognitive skills
- that a systems view of developing a solution should be adopted for students to follow. (Mioduser, 2015, pp. 85–86)

These ideas about effective technology pedagogy could broaden the underpinning perspectives considered in the development of a food technology literacy model.

Lockley and Nicholas (2014) investigated the PCK development of a New Zealand food technology beginning teacher and focused on specific pedagogies that this teacher developed to best meet the needs of her students and their identified learning needs. This appears to be the only New Zealand research conducted with food technology teachers and investigating their PCK. However, this research focuses on a teacher applying the “principles of Choice Theory” (Lockley & Nicholas, 2014, p. 67) to her teaching experiences as a way to gain knowledge of her learners rather than a focus on the overall PCK within the New Zealand food technology curriculum. Consequently, it appears there is the opportunity to further investigate the pedagogy of New Zealand food technology teachers. This helps frame how the research could focus on investigating the implications for providing technological food literacy education for 21st century students.
2.11 Exploring technological food literacy

From this review of the literature, it appears that an examination of technological food literacy, underpinned by a philosophy of technology, has not been conducted previously. There also appears to be no New Zealand food literacy definition. The view that any food literacy definition should consider the Giessen Declaration (Beauman et al., 2005) and incorporate the views of the philosophy of technology (de Vries, 2005; Mitcham, 1994) has been indicated. This researcher proposes that a visual model will provide an accessible method to view this complex concept that allows for an expression of flexibility and contextualisation.

It was discovered that some subject knowledges were identified as being appropriate for a food curriculum. It would be pertinent to discover whether these indicated subject knowledges comprise a comprehensive list of what experts think are the essential components of a food literacy programme. This informs two research foci: to find the attributes of a food literate person and consider how these attributes could be developed in a food technology literacy education programme.

As the New Zealand curriculum does not offer any subject-specific knowledge within the technology curriculum to guide foods teachers, it would be compelling to see what knowledge is considered appropriate in a food curriculum and how this knowledge can be converted into pedagogy. This provides space to consider expert opinions from an educational perspective and provides the framework of the research that considers how teachers interpret this new way of looking at food. It would also be telling to see whether the suggested essential components of a food literacy programme can be combined into a teaching model, especially as this study is based in New Zealand and this forms the basis of a research focus on the interpretation of a food literacy model by foods teachers.

When space was provided in food curricula that permitted the expression of the philosophy of technology, there was an opportunity to consider the rich complexity of food to be included within teaching programmes. It was identified that two countries (England and Australia), whose curricula are underpinned by a philosophy of technology approach, can provide guidance as to what food knowledges may be considered appropriate topics for study.

To date, there has been limited research investigating food technology education supporting the idea of how the philosophy of technology is translated into food technology educational practice. Ideas about modern food technology education in Britain were explored by Rutland and Owen-Jackson (2015a), and they developed a conceptual frame for a modern food
technology curriculum. However, when this frame was mapped to schemes of work in food education, it was found that there were gaps between what key stakeholders thought should be taught in a modern food technology education programme and what the teachers enacted. It would be interesting to know whether this overview of food education is the experience of New Zealand’s foods teachers and whether food education creates any teaching and pedagogic issues. As a result, this gave rise to another research focus to consider: the implications for providing technological food literacy education for 21st century students?

How the Giessen Declaration (Beauman et al., 2005) (see Section 2.3) and the philosophy of technology can be combined in a manner to support teacher practice will now be explored. It was intended that the literature would identify and inform the basic structure of the theoretical food technology literacy model, which is in the next section.

2.12 A theoretical model for food technology literacy

The issue of food education appears complex. A definition cannot reflect the complexity of food and therefore a generic model is suggested. The literature review shows that to educate for food literacy for the 21st century we need to widen the dimensions of curriculum planning. In this literature review, it is proposed to combine ideas of the Giessen Declaration (Beauman et al., 2005) and ideas about food technological practice within an education for technological food literacy. Because of the complexity of components involved, an initial untested model is proposed. This theoretical model acknowledges the principles of the Giessen Declaration (Beauman et al., 2005) and the modes of technology occurring in the food world, where through deliberate design humans work to create food solutions that meet the needs of particular people and populations. Another aspect of this initial food technology model that adds to this complexity is the need to consider the global impact of such an action.

To support the development of the theoretical model, the key phrases from the literature that informed the development of the theoretical food technology literacy model are shown in Table 1. These key phrases from the literature progress down the left-hand column. Firstly, the descriptions from the Giessen Declaration (Beauman et al., 2005) are listed and then ideas about components to consider within the philosophy of technology (de Vries, 2005; Mitcham, 1994, 2001) are given. These descriptions and definitions are used to develop an essence statement descriptor that is used to capture the essence and describe the ideas shown within each section of the theoretical food technology literacy model. The developed essence statement descriptor that describes each section of the model is shown in the right-hand column. The essence statements could provide a basis of a food literacy definition but the complexity and level of interactions
possible cannot be truly comprehended in a definition that incorporates all of these essence statements. The literature identifies all the essence statements, but combining them all would result in a very large written definition. A visual model, the *theoretical food technology literacy model*, is proposed as a method to illustrate these instead.

Table 1. *Essence statement descriptors for sections of the theoretical food technology literacy model, indicating source key phrases from the literature*

<table>
<thead>
<tr>
<th>Literature Informing a Theoretical Food Technology Literacy Model</th>
<th>Essence Statement Descriptors for Sections of a Theoretical Food Technology Literacy Model</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Social Systems</strong></td>
<td>The interaction of food and food cultures with issues that affect the sustenance and happiness of humans.</td>
</tr>
<tr>
<td>Social interactions that influence the long-term sustenance of life on earth and happiness of humankind (Beauman et al., 2005, p. 783)</td>
<td></td>
</tr>
<tr>
<td><strong>Biological Systems</strong></td>
<td>The personal and population health nutritional status that influences and affects the personal health, nutrition adequacy and well-being of people.</td>
</tr>
<tr>
<td>Interactions of food and nutrition with physiologic, metabolic and genomic human systems, nutritional control and prevention of diseases in human health, of both individuals and populations (Beauman et al., 2005, p. 783).</td>
<td></td>
</tr>
<tr>
<td><strong>Environmental Systems</strong></td>
<td>The cultivation, conservation and depletion of living and physical resources resulting from environmental and ecosystem change. The influence of the food manufacturing, retail and distribution systems.</td>
</tr>
<tr>
<td>Deterioration of planetary environments – global climate change, ozone, topsoil, loss of species, chemical pollutants (Beauman et al., 2005, p. 785).</td>
<td></td>
</tr>
<tr>
<td><strong>Technological Activity – which comprises …</strong></td>
<td>How things happen in our world, which produces technological artefacts. This activity utilises …</td>
</tr>
<tr>
<td>Mitcham’s (1994) view of technological activity considers the way in which many things “happen” in our world and the way in which technological knowledge produces artefacts.</td>
<td></td>
</tr>
<tr>
<td><strong>Technological Knowledge</strong></td>
<td>Practical ideas, the making and using of artefacts and</td>
</tr>
<tr>
<td>The knowledge and skills involved in making and using technology (Mitcham, 2001).</td>
<td></td>
</tr>
<tr>
<td><strong>Technological Volition</strong></td>
<td>The will to do, based on a view of reality, ethics and a moral compass.</td>
</tr>
<tr>
<td>Knowledge about the physical world is used by humans to design products, processes and systems (Mitcham, 1994). These actions are related to the person’s world view, and are also influenced by their ethical and aesthetical decisions (de Vries, 2005).</td>
<td></td>
</tr>
<tr>
<td><strong>Technological Artefacts</strong></td>
<td>The food artefacts produced that influence people, populations and our planet. These may be an item or a philosophic stance.</td>
</tr>
<tr>
<td>Articles that transform the natural environment, that fit better with human needs, using all kinds of information and knowledge, natural and cultural resources (de Vries, 2005, p. 11).</td>
<td></td>
</tr>
</tbody>
</table>

It is proposed that a theoretical model (shown in Figure 1) will indicate the possibilities for developing a food technology literacy programme for students. Thus, the model should provide
space to acknowledge the breadth of the issues outlined above as well as show the potential for choice when teachers plan their programmes. This model has not been specially designed for application to *The New Zealand Curriculum* (Ministry of Education, 2007).

To do so, a model has been developed and the next section will describe how it works.

Food is seen as a system, in which a set of things work together in a complex, interconnecting network. The Giessen Declaration (Beauman et al., 2005, p. 783; see Section 2.3) identifies the three dimensions of food systems as being:

“biological … social and environmental” in nature.

Utilising this description from the Giessen Declaration, the theoretical food technology literacy model shows the three systems of nutrition science (biological, social and environmental) as spheres at the top, and these components feed into the theoretical food technology literacy model shown in Figure 1. These represent that they are specific spheres of knowledge.

The Giessen Declaration (Beauman et al., 2005, p. 784) suggests that each dimension interacts with:

“human, living and physical resources”.

In this model, there is the presumption that these are resources that can be cultivated, conserved or used to sustain human life (Beauman et al., 2005). The human world refers to resources such as people’s skill levels and knowledge, man-made structures and the expected life expectancy of populations (Adams et al., 2002). The living world encompasses the natural world of plants and animals and how they can be harnessed (Adams et al., 2002). The physical world includes the energy sources in the world, such as wind, wave, solar and biofuel, and the raw materials that the world might produce, such as cotton, iron ore, forestry and harvest from the sea, as well as the logistics of their supply (Adams et al., 2002). These worlds are situated inherently within the biological health, social and environmental dimensions, and are utilised from each dimension. The worlds do not hold equal and constant interrelationships with each sphere. Some spheres may have aspects of each world that interrelate in a minor way; this is dictated by the drive of technological activity and volition. The dominance or otherwise of each will depend on the aspect of food that is being considered and which aspect is regarded of paramount importance.

Finally, the Giessen Declaration (Beauman et al., 2005, p. 783) suggests that new nutrition science is ultimately concerned with:
“personal, population and planetary health”.

The nesting containers at the base of the theoretical food technology literacy model acknowledge this idea and suggest that the technological artefacts produced have an influence on people, populations and the planet.

It is proposed that the theoretical food technology literacy model provides a way of looking at the resources of food and their associated systems and all the constituents interacting from a technological perspective. The rich complexity of the food world and the way humans use knowledge and volition on food systems means that a way of clarifying the connections is required. The philosophy of technology provides a framework to mediate with these dimensions of food. These technological connections and interactions are represented in the theoretical food technology literacy model as two sides of the funnel in the centre of the diagram, where technological activity occurs, creating food artefacts that nest in the containers at the bottom of the diagram.

In this model, technological activity is represented by a funnel. As different liquids can flow through a funnel, there is the potential for an infinite number of ways that the food systems and worlds can connect and touch each other. These interconnections could have an effect that is fleeting or be of a more permanent nature. This activity is technological, as human activity mediates the connections. What is significant in this model is that the funnel is a visual metaphor for technological activity and potential change in the food as it tumbles through the funnel towards a technological food outcome. This outcome can affect the person or a population group as well as having a global influence.

There is a feedback mechanism in the theoretical food technology literacy model indicated by the arrows that feed from the nested containers back to the funnel. These arrows acknowledge that the knowledge gained by prior actions can feed back into the theoretical food technology literacy model to provide valid knowledge formation that might inform future actions.
Figure 1. *The theoretical food technology literacy model*

*Note.* The food systems and associated resources feed into the technological activity funnel, which produces technological artefacts that affect the person, populations and the planet. Feedback is also shown by the arrows.

### 2.13 Chapter summary

To fully explore the rich complexity of food, the need for a robust underpinning philosophy that can support and reflect all aspects of food has been discussed. In this chapter, a conceptual frame, inclusive of the wide range of views about food, has been presented. In seeking a definition of food literacy, a word definition was rejected in favour of a model that could show the complexities of ideas that underpin this concept. The model is underpinned by an idea that food is a technological outcome that can be characterised by the ideas expressed in the Giessen Declaration (Beauman et al., 2005) and the philosophy of technology (de Vries, 2005; Mitcham, 1994). To identify this complexity in detail, essence statements have been developed from the literature that inform the underpinning ideas of food literacy. The words underpin the model and are reflected in the essence statement related to that aspect. This theoretical model of food technology literacy is proposed (see Figure 1) that reflects the diversity of these inputs and outcomes. However, it is difficult to identify what from this broad bank of subject knowledge is considered important to transfer into food education. Views about food from experts in the field may help to build a comprehensive understanding of what attributes contribute to the knowledge
base of a food literate person. Once these attributes are identified, it may be possible to determine the food education that could develop these attributes. Consequently, a key research question is: What are the attributes of a food literate person?

There is the potential for a wide and broad range of attributes to be developed; as a result, it is fruitful to determine what experts think are the essential topics for classroom programmes in food education. Therefore, a further research question is posed: What components are deemed essential for a technological food literacy education programme?

It has been established in this literature review that food education is a complex concept. From an international review of the literature considering how food education is presented in schools, it has been shown that food has a variety of different emphases in each country’s curricula. Literature exploring the range of existing food literacy definitions has been reviewed in order to show the dimensions of food literacy. It appears that in order to educate in food for the 21st century, a wider and deeper perspective of food technology literacy is warranted.

Curricula are interpreted through teachers’ social and experiential interactions and it is suggested through food curriculum statements that food education in schools could occur with learning theories that employ an experiential and social manner.

As learning in a school setting is also influenced by the underlying interests of teachers, a review of relevant pedagogy has been completed. There has been little research about food education, particularly in New Zealand, and therefore it is difficult to identify what pedagogic issues are problematic for foods teachers. As a result, particular reference is made to the New Zealand context and expressions of pedagogies utilised with expressions of the technology curriculum are considered, as this is one way that food education is explored.

Because teachers play an important role in deciding and developing students’ learning, this research deems it important to consider their views about what aspects of food can be developed and taught in the classroom. As a result, a research question is posed: What are teachers’ interpretations of the components of technological food literacy? To aid in the understanding and use of these components by teachers, a further question is posed: How is the food literacy model interpreted by foods teachers?

It appears that there are certain consensus ideas that exist about what an effective pedagogy should consider, irrespective of differences in underpinning philosophy, culture and society where the education is conducted. However, there is little research that considers what technological food literacy pedagogy might consider. Therefore, a final research question that
concludes this research is *What are the implications for providing technological food literacy education for 21st century students?*

To summarise, these five questions that emerged from the literature review have guided this research. The results of these five questions inform the aim of the overall research, which is *to investigate the attributes of a 21st century technological food literacy in order to build a model of technological food literacy education that may enable foods teachers to develop their pedagogy.*
Chapter 3: Methodology

3.1 Introduction

The purpose of this research was to identify the attributes of food literacy for a 21st century education and examine how these elements could be combined as a teaching model. This chapter outlines the methodological frame used within this project that enabled this aim to be investigated. In Section 3.2, the use of an interpretivist paradigm and a mixed methods approach within this project is justified. The selection of research tools is detailed and how they were used to collect data is provided. The reasons for using questionnaires, interviews, the Delphi methodology and document analysis are explored and justified. The selection of participants is described in Section 3.3. A description of the research design is found within Section 3.4, which discusses the four data collection methods used. Section 3.5 reviews and describes the data analysis processes. Legitimation issues are reviewed in Section 3.6. The ethical considerations relevant to this research are discussed in Section 3.7. A summary providing an overview of the chapter is provided in Section 3.8.

3.2 Research methodology – An interpretivist paradigm

This research required an approach that could interpret the thoughts and actions of people in the food community when they were reflecting upon the elements of food literacy for the 21st century. Describing and characterising the attributes required an interpretivist paradigm as this research is embedded in “the world of human experience” (Cohen & Manion, 1994, p. 36) and it was anticipated that there would be a reliance on investigating the views of participants about the situation to develop meaning (Creswell, 2009). As discussed in Chapter 2, there is no one definitive definition of food literacy (see Section 2.6.4), so the research needed to provide scope to “develop a theory or pattern of meaning” (Creswell, 2009, p. 8). An interpretivist paradigm allows space for social interactions to be interpreted (Creswell, 2009; Neuman, 2001) and to “understand and see things through the eyes of the respondents” (Neuman, 2001, p. 76). By using this approach, it was hoped that an understanding would be gained of how the respondents constructed their concept of reality and “how they assign meanings to it” (Sarantakos, 2013, p. 40). It was also hoped that the participants would become active in creating the meaning behind the food-related activities they were involved in.

A mixed method research approach was selected as this enabled the strengths of both the qualitative and the quantitative research paradigms to be harnessed (Punch, 2009). Mixed method methodology is described as a method that utilises comparisons between quantitative
and qualitative data (C. Jones, 2004). This approach provides scope for diversity and allows for the use of one approach to “better understand, explain, or build on the results from the other approach” (Creswell, 2009, p. 205). The fundamental principle behind utilising a mixed methods approach in this research was to provide complementary strengths to the research project and provide confirmation of consensus, elaboration of ideas and “initiate new lines of thinking” (Miles & Huberman, 1994, p. 41) about food education. This mixed method approach used a sequential explanatory strategy (Creswell, 2009). This strategy involved collecting and analysing the first round of qualitative data, followed by a second round of quantitative data collection and analysis, which added onto the results of the first round. This approach was selected because it permitted for unexpected results to arise and be explored in more detail (Creswell, 2009).

The research approach utilised four research tools (see Table 3). First, semi-structured interviews were used with the phase one food experts and the phase three foods teachers. The food expert interviews and intervention teacher interviews were individually conducted when opinions on food literacy were sought. Focus group interviews were conducted with groups of New Zealand foods teachers in the second phase of the project. Secondly, questionnaires were used in part of phase one as part of a Delphi methodology in the form of Likert scale questionnaires. The third research tool used Delphi methodology (Delphi) to identify the attributes of a food literate person. The third phase of the project used an intervention in which teachers undertook to teach a component of food literacy within their Year 9–10 food technology classrooms. The fourth research tool used document analysis of their supporting lesson plans to understand how teachers planned, expressed and enacted teaching about the components of food literacy.

The reasoning for the selection of these methods will now be explored.

**3.2.1 Interviews**

This interpretivist methodology had a goal of probing to gain a deeper understanding of the responses of these experts (Neuman, 2001). Semi-structured interviews were used in phases one and three of the research. In phase one, semi-structured interviews were used to enable the interviewer to “gain meaning of the culture” (Sarantakos, 1998, p. 251) from where these experts came. Open-ended questions were used; these are regarded as allowing people the “freedom to express feelings and thoughts” (Sarantakos, 2013, p. 256) in a semi-structured interview methodology. Foddy (1993) indicates that answers to open questions allow for the “motivational influences and frames of reference” to be identified (p. 132).

56
Using the semi-structured format in these interviews allowed some freedom by the researcher to probe and inquire (Sarantakos, 2013). This was particularly valid during phase three of the research. The qualitative questions posed to the intervention study teachers sought to “allow the participants to explain their ideas” (Creswell, 2009, p. 141) about food literacy and the attributes a food literate person might exhibit as well as how to teach a food literacy component. This strategy is supported by Sarantakos (2013) who states that the participants may be encouraged to “continue with their response” (p. 288).

Semi-structured interviews were also used in phase two in a focus group setting. The focus group interviews sought information from teachers to answer the research question “How can the essential elements of a food literacy programme be combined as a teaching model?” Cohen, Manion and Morrison (2011) describe focus groups as “contrived settings, bringing together a specifically chosen sector of the population ... to discuss a theme or topic, where the interaction with the group leads to data and outcomes” (p. 436). Merton and Kendall (1946) also discuss the “focussed” interview and describe the basic purpose of this approach “to gather qualitative data from individuals who have experienced some ‘particular concrete situation’ which serves as the focus of the interview” (p. 541). It was hoped this approach would allow access to the opinions and attitudes of foods teachers.

### 3.2.2 Questionnaires

Questionnaires were used in the first phase as Likert scale questionnaires within the Delphi.

Likert scale questionnaires were used within the sequenced rounds of the Delphi in phase one and were administered by an email-based SurveyMonkey format (www.surveymonkey.com). Likert scales are a unidimensional scaling method in which interest in a topic is measured on a numbered line (Trochim, 2006). Likert scales are used to measure attitudes by providing a range of responses to a given statement (Jamieson, 2004). The data collected is ordinal as they have an inherent sequence (1, 2, 3, etc.) However, the intervals between them cannot be regarded as equal (Jamieson, 2004) but are often treated as if they are (Blaikie, 2003). This is an important consideration as it affects how the data from a Likert scale is analysed to show statistical differences (Jamieson, 2004). Semantics also play an important role in the development of a Likert scale (Lam & Kolic, 2008). Lam and Kolic (2008) reflect on the work of Ostrom and Gannon (1996), which indicated that the labels on the Likert scale questionnaires can “activate cognitive categories with similar semantic content” (Lam & Kolic, 2008, p. 250). It was hoped that the Likert scales would create the space for these experts to be flexible with their responses.
about food literacy components but also allow for some quantitative analysis to be conducted (Cohen et al., 2011).

3.2.3 Delphi

A Delphi methodological approach was implemented in phase one of the research project that focused on the research question “What are the attributes of a food literate person?”

Delphi is a method for structuring a group communication process so the process becomes effective in allowing a group of individuals, as a whole, to investigate a complex problem. It is considered a useful technique to use with curriculum research, for example, when a consensus of opinion is the end point (Wiersma & Jurs, 2005). Essentially, it is a series of sequenced questionnaires or rounds that are reviewed and fed back to a group of experts, with the aim of gaining a reliable consensus of opinions (Linstone & Turoff, 1975). This technique is identified as being useful when the individual judgements of experts from diverse backgrounds are sought; they are then combined to contribute to knowledge about solving problems (Delbecq, Van de Ven, & Gustafson, 1975). To accomplish structured communication, the Delphi demonstrates the following characteristics: feedback of individual contributions of information and knowledge, an assessment of the group judgement or view, the opportunity for individuals to revise views, and allowing a degree of anonymity for the individual responsible (Linstone & Turoff, 1975). These characteristics allow for collective intelligence to be gathered about the issue. Using a Delphi method permitted collective opinion from food experts to be sought. These opinions were developed from these experts’ individual judgements about the attributes of a food literate person.

3.2.4 Document analysis

Document analysis was used in phase three of the project. Phase three sought to answer the research questions “How is a food literacy teaching model interpreted and actioned in a food education classroom?” and “What are the implications for providing food education for 21st century students?” Sarantakos (1998) indicates that the use of document research assists to “ascertain aspects of the issue in question and the main ideas, statements and thoughts on the subject” (p. 275). Cohen et al. (2011) indicate that teaching documentation could be compared with teachers’ interview data to help investigate teacher ideas about curriculum and pedagogy. The advantage of using document analysis of the teachers’ unit plan for the teaching of the food literacy component was that discussions with the teachers about their teaching could be strengthened by using the unit plans as a reference point during semi-structured interviews. Unit plans are easily accessible from teachers and contain an large amount of high-quality
information to help explain what was told to the interviewer during the semi-structured interviews.

3.3 Selection of participants

Specific participants who fitted particular criteria were identified for each phase of the project and this affected the type of sampling used. The use of criteria assisted to make sure that all participants were relevant to the topic (Sarantakos, 1998). The criteria and sampling type for each phase will now be explained.

3.3.1 Phase one – Purposive, homogeneous sample

Purposive sampling is where “the researchers purposely choose subjects who, in their opinion, are thought to be relevant to the project” (Sarantakos, 2013, p. 177). Teddlie and Yu (2007) describe this form of sampling in mixed methods research as a way to achieve “representativeness or comparability” in an area of interest (p. 81). It was intended that with purposive sampling particular experts might offer more valid and useful information for in-depth investigation (Neuman, 2001).

Decisions needed to be made about the selection of the food experts and the numbers to ensure a homogeneous sample was gained by utilising the purposive sampling method. A homogeneous sample of participants focuses on participants sharing particular characteristics and reduces the variation between them (Patton, 1990). This form of sampling was conducted to attain a balanced viewpoint of food within the wider dimensions of food indicated in Chapter 2. The particular characteristics for the expert panel selection were based on the information that they had placed in the public domain such as editorials, opinions, presentations and academic writings about food. Five participants for each food dimension discussed in Chapter 2 were identified (\( n = 40 \)), and were invited by formal letter through email and post to take part in the research. A homogeneous sample of 24 experts from a range of food-related fields were interviewed. This sample size falls within the range Hasson, Keeney and McKenna (2000) suggest is required to provide adequate representation. The backgrounds and fields of expertise of this panel of experts is summarised in Appendix A Defining the experts.

3.3.2 Phase two – Focus groups

Krueger (1994) indicates that a “focus group is a special type of group in terms of purpose, size, composition, and procedures” (p. 6). Krueger (1994) suggests that “focus groups are best conducted with participants who are similar to each other” (p. 14). Group size was considered in accordance with Morgan (1998) and Krueger (1994), who indicate that focus groups are best
when they comprise between six and 10 participants. Krueger also indicates that the “focus
group is repeated several times with different people. Typically, a focus group study will consist
of a minimum of three focus groups” (Krueger, 1994, p. 6). Focus group discussions were held
with foods teachers to discuss how the suggested elements of a food literacy programme could
be combined as a teaching model.

The focus group participants were drawn from the contact and consent forms provided at a
conference and at subject-specific meetings that indicated that they could be invited at a later
stage to participate. The contact details were divided into regions in New Zealand. There was
sufficient response from people to hold four focus groups, three in the Auckland region and one
in the Bay of Plenty.

The demographic information of participants that attended are shown in Table 2. Any names
identified are pseudonyms chosen by the respondents.

Table 2. Focus group participant demographic information

<table>
<thead>
<tr>
<th>Pseudonym</th>
<th>Age Band</th>
<th>Chosen Ethnicity</th>
<th>Education</th>
<th>Years of Teaching Experience</th>
</tr>
</thead>
<tbody>
<tr>
<td>Molly</td>
<td>55–64</td>
<td>Pakeha NZer</td>
<td>Postgraduate Qualification</td>
<td>15–19</td>
</tr>
<tr>
<td>Jackie</td>
<td>45–54</td>
<td>NZer</td>
<td>Degree</td>
<td>20+</td>
</tr>
<tr>
<td>Pippin</td>
<td>45–54</td>
<td>NZ European</td>
<td>Graduate Teaching Diploma</td>
<td>20+</td>
</tr>
<tr>
<td>Victoria</td>
<td>18–24</td>
<td>NZ European</td>
<td>Degree</td>
<td>0–4</td>
</tr>
<tr>
<td>Lynn</td>
<td>35–44</td>
<td>American</td>
<td>Postgraduate Qualification</td>
<td>0–4</td>
</tr>
<tr>
<td>Pollyanna</td>
<td>45–54</td>
<td>NZ European</td>
<td>Graduate Teaching Diploma</td>
<td>20+</td>
</tr>
<tr>
<td>Fran</td>
<td>45–54</td>
<td>Cook Islander</td>
<td>Degree</td>
<td>20+</td>
</tr>
<tr>
<td>Preti</td>
<td>25–34</td>
<td>Fiji Indian</td>
<td>Graduate Teaching Diploma</td>
<td>5–9</td>
</tr>
<tr>
<td>Annabel</td>
<td>45–54</td>
<td>Kiwi</td>
<td>Graduate Teaching Diploma</td>
<td>10–14</td>
</tr>
<tr>
<td>Dorothy</td>
<td>35–44</td>
<td>NZer</td>
<td>Postgraduate Qualification</td>
<td>0–4</td>
</tr>
<tr>
<td>Helen</td>
<td>35–44</td>
<td>Kiwi</td>
<td>Degree</td>
<td>10–14</td>
</tr>
<tr>
<td>Sami</td>
<td>55–64</td>
<td>NZer</td>
<td>Graduate Teaching Diploma</td>
<td>20+</td>
</tr>
</tbody>
</table>

The focus groups met for approximately one and a half hours to answer the questions listed in
Appendix B Indicative Focus Group Questions.

The questions sought to identify these teachers’ perceptions of the components of technological
food literacy. The questions focused the respondents’ interpretation of teaching the components
of technological food literacy. Respondents were asked to reflect on their views of and
interactions with the components in the teaching of food technology within the technology
learning area of The New Zealand Curriculum (Ministry of Education, 2007). Questions were
asked about how they perceived the components, and how they would interpret and teach each component, providing and examples.

### 3.3.3 Phase three – Intervention study

The intervention with teachers is best described as a “non-experimental design intervention study” (NeDIS) (Fisher & Foreit, 2002, p. 54). A NeDIS is a study design in which only the intervention (in this case, the teaching programme about food literacy) is conducted and no control group is used as a comparison, making it difficult to make suggestions about what could have happened without the intervention. Fisher and Foreit (2002) state that “these designs are most appropriate for collecting descriptive information or for doing small case studies” (p. 54). Borman (2009) discusses the challenges of experimenting in the school/classroom environment and argues for the use of non-experiments rather than the perceived gold standard randomised experiment as they often provide “important supplementary information that helps stakeholders understand the potential effects of the treatment when it is implemented as intended” (p. 136). Borman (2009) also indicates that “small qualitative case studies or relatively small quantitative studies … would help reveal the general promise of the approaches, troubles with implementation, sustainability of the efforts, and unexpected side effects” (p. 137).

Six focus group participants offered at a later date to participate in the intervention study. The researcher had specific participants in mind for the project so criteria were used for the purposive sampling in this stage of the research project as the project focused on a small subject subset of food education teachers. It was intended that with the use of purposive sampling the participant teachers might offer more valid and useful information for in-depth investigation (Neuman, 2001) as they held an interest in food and food education.

The purposive sampling sought participants who were:

- experienced teachers of food technology
- had two to three years of teaching experience
- were actively teaching a junior level (Year 8–10) food technology class
- were involved in writing their own programmes of teaching.

All six teachers were invited to be involved. Two teachers declined the invitation to participate once they read the information sheets and considered the suitability of the classes they taught; and one principal declined the researcher access to the school.
3.4 Research design

Each of the research phases sought to answer different research questions and these questions are indicated in the first column of Table 3. A variety of data collection methods were used to ensure the evidence was credible and trustworthy (Guba & Lincoln, 1989). How the four data collection methods were administered is explained. Each instrument will then be discussed in turn.
<table>
<thead>
<tr>
<th>Phase and Research Question</th>
<th>Data Collection Method</th>
<th>Details of How Administered</th>
<th>Participant Selection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase one: Semi-structured expert interviews RQ: What are the attributes of a food literate person?</td>
<td>Instrument 1: Delphi: Semi-structured interviews with expert panel</td>
<td>Conduct interviews at agreed locations, data generation through individual expert interviews. Pattern coded themes. Inter-rater reliability (Cohen’s kappa) and confidence interval calculated on themes identified to confirm coding.</td>
<td>Purposive sampling of experts from information they had placed in public domain. Experts placed in categories that reflected the wider food concepts.</td>
</tr>
<tr>
<td>RQ: What components are deemed essential for a food literacy education programme? (Phase One Questionnaire 1 Likert in the Delphi Sequence)</td>
<td>Delphi: Semi-structured interviews with expert panel Likert questionnaire</td>
<td>Likert scale questionnaire in which components of food literacy are rated on their essentiality. Asked for reasoning to the rating. Mean, median, interquartile range, mode and standard deviation calculations. Also skew and kurtosis of data. Final decision: Analysis using mode and rankings of frequency on Likert scale. Code comments about the essentiality of component made by experts into themes.</td>
<td></td>
</tr>
<tr>
<td>RQ: What components are deemed essential for a food literacy education programme? (Phase One Questionnaire 2 Likert in the Delphi sequence) aiming towards reaching a consensus</td>
<td>Delphi: Semi-structured interviews with expert panel Likert questionnaire</td>
<td>Likert scale questionnaire where components are rated and consensus on essentiality to food literacy of each component sought. Mean, median, interquartile range, mode and standard deviation calculations. Also skew and kurtosis of data. Final decision: Mean of 3.75 given by 75% of expert panellists for each component. Code comments about the reasoning behind the rating for the essentiality of component made by experts into themes.</td>
<td></td>
</tr>
<tr>
<td>Phase two: Focus groups RQ: What are teachers’ interpretation of the components of technological food literacy?</td>
<td>Instrument 3: Focus group discussions</td>
<td>Verifying themes from Delphi shown as components of food literacy model. Discuss themes and issues identified. Pattern coded themes. Code comments about the component of food literacy and definitions developed.</td>
<td>Convenience sampling – request at conference presentations for contact details.</td>
</tr>
<tr>
<td>Phase three: Intervention study RQs: How is the food literacy model interpreted by foods teachers? What are the implications for providing food education for 21st century students?</td>
<td>Instrument 4: Teaching intervention: Interviews and document analysis</td>
<td>A series (3) of semi-structured interviews with teachers (pre/during/post teaching intervention) conducted. Lesson and unit planning documents provided for analysis.</td>
<td>Purposively sampled from focus group discussion participants.</td>
</tr>
</tbody>
</table>
3.4.1 Phase one – Semi-structured expert interviews about food literacy

Experts from a range of food-related fields were interviewed using semi-structured open-ended questions (see Appendix C Initial indicative open ended interview questions). Purposive sampling was used in which “the choice of respondents is guided by the judgement of the investigator” (Sarantakos, 2013, p. 177). Teddlie and Yu (2007) describe this form of sampling in mixed methods research as a way to achieve “representativeness or comparability” in an area of interest (p. 81). It was intended with purposive sampling particular experts might offer more valid and useful information for in-depth investigation (Neuman, 2001).

The expert interviews were conducted one on one and utilised indicative questions. Probing the responses was assisted by the use of open-ended questions. These interviews were conducted at a place of the participants’ choosing and were audio-taped. The tapes were transcribed and the participants were given a copy of the transcript for review.

3.4.2 Phase two – Focus groups of teachers about components of food literacy

The focus groups were posed semi-structured open-ended questions (see Appendix B Indicative Focus Group Questions) that encouraged people to express their views (Sarantakos, 2013) to assist in identifying whether the components of technological food literacy were appropriate. These focus groups were run at mutually agreeable times. Two were run in a private meeting room, and two were run in school meeting rooms. All teacher participants were active teachers in junior food technology programmes in the 2011 school year. The focus groups were digitally recorded, and the tapes transcribed. The focus groups ran for approximately one and a half hours and were facilitated by the researcher.

3.4.3 Phase three – Teachers trialling teaching with a component of food literacy

Six focus group participants offered to be invited at a later date to participate in the intervention study and three were selected. It was intended that with the use of convenience sampling the participant teachers might offer more relevant information for in-depth investigation (Miles & Huberman, 1994).

The intervention teacher interviews were conducted one on one and utilised indicative questions that focused on their teaching. Probing the responses was assisted by the use of open-ended questions. These interviews were conducted at a place of the participants’ choosing and were recorded. The digital recordings were transcribed and the participants were given a copy of the transcript for review. The interviews were conducted prior to, during and after the teaching of the unit of work that reflected a component of technological food literacy.
3.5 Data analysis

The data was categorised in an ongoing manner throughout the data collection phase. Sarantakos (2013) identifies the data collection steps as how the data collected is “coded, conceptually organised, interrelated, analysed, evaluated and then used” (p. 367). This stage is critical to making meaning of the information provided, and the analysis should be done in a way to ensure that the meanings identified are valid, repeatable and right (Miles & Huberman, 1994). In a mixed methods study that utilises a sequential exploratory strategy, it is expected that the first phase of qualitative data collection and analysis be followed by a quantitative data analysis that, in turn, builds onto the results of the first phase (Creswell, 2009).

The process of data collection and data analysis was completed with a mixed methods approach using a sequential explanatory strategy (Creswell, 2009). This mixed methods approach matched the expectation of the Delphi in that it allowed for the uncertainty of the feedback from the experts to be explored. There were four methods of data collection utilised and a research design overview is provided in Table 4.

The time frame for the collection of data was a two-and-a-half-year period, October 2009 to May 2012. Each data instrument had its own analysis method and these are now discussed in turn.
<table>
<thead>
<tr>
<th>Research Question and Stages</th>
<th>Time Line</th>
<th>Source of Data</th>
<th>Mixed Methods Sequential Explanatory Strategy:</th>
</tr>
</thead>
</table>
| **RQ:** What are the attributes of a food literate person?  
Phase one:  
Delphi: Semi-structured interviews with expert panel | February 2010 to November 2010 | Conduct interviews at agreed locations, data generation through individual expert interviews. Interviews transcribed, returned for verification. | QUALITATIVE:  
Pattern coded themes.  
Develop components of food literacy model.  
Quantitative:  
Inter-rater reliability (Cohen’s kappa) and confidence interval calculated on themes identified to confirm coding. |
| **RQ:** What components are deemed essential for a food literacy education programme?  
Phase one, Questionnaire 1:  
Questionnaire 1 Likert in the Delphi Sequence and comments from experts completed by email | March to April 2011 | Components of food literacy model returned to experts for ranking and comment.  
Develop Likert scale questionnaire where components of food literacy are rated on their essentiality. | QUANTITATIVE:  
Mean, median, interquartile range, mode and standard deviation calculations. Also skew and kurtosis of data. Final decision: Analysis using mode and rankings of frequency on Likert scale. This reduced the components of food literacy in number.  
Qualitative:  
Inductive thematic analysis of the essential components. |
| Phase one, Questionnaire 2:  
Questionnaire 2 Likert in the Delphi sequence and comments from experts completed by email | June to July 2011 | Reduced components of food literacy model and descriptors returned to experts.  
Develop Likert scale questionnaire in which reduced components are rated and consensus on essentiality to food literacy of each component sought. | QUANTITATIVE:  
Mean, median, interquartile range, mode and standard deviation calculations. Also skew and kurtosis of data. Final decision: Mean of 3.75 given by 75% of expert panellists for each component.  
QUALITATIVE:  
Comments coded for essentiality, development of definitions for components of food literacy. |
| **RQ:** What are teachers’ interpretations of the components of technological food literacy?  
Phase two:  
Focus group discussions | December 2011 to February 2012 | Themes identified in data analysis and shown as in components of food literacy model.  
Hold focus group discussions.  
Initial analysis shared with teachers as model.  
Discuss themes and issues identified.  
Discuss how component might be taught within current New Zealand Curriculum (2007) guidelines. | QUALITATIVE:  
Pattern coded themes.  
Code comments about the component of food literacy and the definitions. |
| **RQs:**  
What are teachers’ interpretations of the components of technological food literacy?  
How is the food literacy model interpreted by foods teachers?  
What are the implications for providing technological food literacy education for 21st century students?  
Phase three:  
Teaching intervention: Interviews and document analysis | February 2012 to May 2012 | Conduct interviews at agreed locations, data generation through individual teacher interviews. A series (3) of semi-structured interviews with teachers (pre/during/post teaching intervention) conducted.  
Lesson and unit planning documents provided for analysis.  
Exemplars of students work provided for analysis. | QUALITATIVE:  
Pattern coded themes.  
Lesson planning document analysis.  
Exemplars of students work explored to see how student thinking on a component of food literacy may have developed during teaching programme. |
3.5.1 Phase one – The Delphi sequence data analysis

The purpose of this research phase was to identify the consensus about the attributes of a food literate person, and these were initially identified through the interview responses. The interviews were initially qualitatively analysed with NVivo 8 using a pattern coding system (Miles & Huberman, 1994, p. 69) by which emerging common themes were identified.

To confirm the reliability of the researcher’s coding, inter-rater reliability was carried out. A 20% \( (n = 127) \) sample of these statements was generated using the Excel random number formula. These comments were recoded by an independent researcher (rater) who used the same pattern coding rules. This process was conducted to identify how closely the two raters agreed or disagreed in the application of the coding rules to the interview statements. Once the two raters had coded the data, a Cohen’s kappa statistic calculation using SPSS software was utilised to check whether there was a similar level of agreement between the two raters. After adjusting for a proportion of agreement that could be expected because of chance, the kappa statistic generated measured the proportion of agreement that was actually observed between the raters, and the confidence interval (CI) indicated how statistically reliable the data was.

As a result, the kappa statistic could be used to identify statistical significance. A CI could be calculated from the observations. The CI indicates the possible range around the kappa statistic based on the standard error of the measurement. A stable kappa statistic would be indicated by a CI being reported that is narrow in range and close to the same value. This process indicates the statistical reliability of the kappa statistic being true over all the data collected or if the survey was repeated. Therefore, the Cohen’s kappa and the CI are reported as this analysis gave substance to the data analysis.

3.5.1.1 Phase One Questionnaire 1 Likert in the Delphi Sequence data analysis

It was intended that the results of the Phase One Questionnaire 1 Likert (see Appendix E) would provide a response to the quantitative research question for this stage of the research:

“What statistical evidence will show that some components of food education were deemed more essential than others?”

The intent of the series of rounds in the Delphi technique is to gain a convergence of expert opinions on the predictions that have been given (Hill & Fowles, 1975). However, a large amount of discussion exists in the literature about how this converging opinion is decided upon. Powell (2003) comments that there appear to be “no firm rules for establishing when consensus is reached” (p. 379) in the Delphi sequence and that understanding the mechanism used to
establish consensus is often not mentioned in studies. Fink, Kosecoff, Chassin and Brook (1984) suggest that the idea of consensus should “be defined in advance” (p. 982) and indicate that in many cases a benchmark of 70% consensus is used. Murphy et al. (1998) consider how consensus is reached and indicate that mechanisms used to aggregate scores may be open to arbitrary decision-making by the researchers.

Prior to analysis, it was determined that the quantitative analysis of the food literacy education components was to be conducted by use of a mean, median and interquartile range, as suggested by Wedley (1977). Values were associated with each response point, from “not at all essential” answers scoring a 1 through to “absolutely essential” answers scoring a 5, and a mean score for each component was generated. It was intended that a suggested component of food literacy education be retained if 75% of the experts rated it greater or equal to a mean of 3.75.

The expert comments that were made during Phase One Questionnaire 1 Likert in the Delphi Sequence were linked qualitatively back to each component and considered alongside the rating the expert had also given that component. Coding of any recurrent themes occurred. For example, it was found that several experts noted some discord with the term “Food systems” as a component and this had affected the rating they had given this component.

The mean and interquartile ranges were first calculated. Initial reflection on the means showed they were all to be higher than the expected normal distribution of 3. The standard deviations showed that the data was held quite closely around the mean, and the variance calculated indicated that for some components there was only a small deviation of all the numbers away from the mean. Concern arose that the analysis was not being true to the data as standard deviation does not always show a good measure of spread if the distribution of the data is not normal. The interquartile range was then calculated to indicate if the data was skewed.

The median was also initially investigated, with reference to Dalkey (1975) who suggested that the median could be a surrogate for the mean if the distribution was normal and “has been the most widely used statistic in applied studies for the representative group response” (p. 243). However, it was noted that the Likert scale questionnaire ratings all appeared to be negatively skewed. This skew indicated certain attitudes of these experts to the components and suggested that attention needed to be paid to the qualitative data collected in tandem with the statistical analysis. The skew and kurtosis were investigated and it was found that all data (except for one component) held a negative skew so use of the median was inappropriate as a quantitative analysis tool.
The two categories “quite essential” (4) and “absolutely essential” (5) indicated clustering of the experts’ responses for the components’ essentiality. This indicates that there was some degree of consensus between these experts that these components were to be highly ranked. There was a level of discrimination being shown by the experts and this needed to be reflected in the analysis of the results. Consequently, the frequency of the responses (mode) was checked. As the data came from categorical data, it was thought that the mode could indicate the most common value chosen by the experts. As the location of the mode in data can be atypical of the data set, the concentration of the data was also calculated to see the range within which most of the rankings fell: that is between 1 and 2, 2 and 3, 3 and 4, or 4 and 5.

Following the review of this analysis, it was determined that the analysis of Phase One Questionnaire 1 Likert would be conducted using the mode, and where the rankings banded together with greater frequency on the rating scale. The five lowest-rated components for both the mode and the frequency were removed from the Phase One Questionnaire 2 Likert in the Delphi.

3.5.1.2 Phase One Questionnaire 2 Likert in the Delphi Sequence data analysis

With Phase One Questionnaire 2 Likert in the Delphi Sequence (shown in Appendix F), these experts were asked to rate the extent to which they agreed that the component of food literacy and the descriptor of it provided was absolutely essential in a food literacy education programme. Values were associated with each response point, from “strongly disagree” scoring a 1 through to “strongly agree” scoring a 5.

In the section describing Phase One Questionnaire 1 Likert in the Delphi Sequence, the original plan was that the quantitative analysis of the food literacy education components would be conducted by use of a mean, median and interquartile range, as suggested by Wedley (1977), but this was altered as described above. However, this plan was adhered to for analysis of Phase One Questionnaire 2 in the Delphi Sequence.

It was intended that a suggested component of food literacy education be retained if 75% of the experts ranked it greater or equal to a mean of 3.75. A mean score for each component was generated. Initial reflection on the means showed that they were positively skewed with a slightly higher than expected normal distribution of 3, with a mean of 3.85. The decision was made to keep to the ranking of a mean of 3.75 by 75% of the experts.

For most suggested components of food literacy, the standard deviation calculations sat quite closely around the mean, meaning the experts rated the component quite closely to each other.
The mean calculation reduced the 17 suggested components from Phase One Questionnaire 1 Likert results to 12 suggested components for Phase One Questionnaire 2 Likert, with the means ranging between 4.35 and 3.85. The essential components that were removed were found to have a lower mean (ranging from 3.15 to 3.55), a higher interquartile range and a larger deviation in variance of the scores. This result suggests that the experts were not in close agreement about that component’s rating of essentiality and clearly discriminated between those and the suggested essential components in a food literacy education programme.

The experts were also asked to explain the reasoning behind the rating they gave each component. This is in line with Powell Kennedy’s (2004) suggestion that allowing for the experts to illustrate their perspective can provide information on “how Delphi studies can be enhanced, expanded or clarified” (p. 510).

3.5.2 Phase two – Focus groups data analysis

The purpose of these focus groups was to establish a viewpoint of the components of technological food literacy from a practising teacher’s perspective. The components of technological food literacy were presented to the focus groups as a list, which comprised the component and a definition as shown in Appendix B Indicative Focus Group Questions.

The components of technological food literacy needed to provide clear, concise, relevant information about food literacy that could be applied to the teaching of food education. As a result, questions that investigated the practicality of teaching such components and the perspective and opinion about the components were asked.

A semi-structured questioning approach within an interviewing schedule was used to ensure consistency in the questions asked across all the focus groups, with some set prompting and probing guides suggested to allow for flexibility and depth of answers (Wheatley & Flexner, 1988). The questions were focused on gaining an understanding of teachers’ perceptions about the suggested components of food literacy.

3.5.3 Phase three – The teaching study data analysis

Document analysis was used in phase three of the project. The teachers’ unit plans for teaching the components of technological food literacy were obtained. A framework for the unit plans is found in Appendix D.

The advantage of using document analysis of the teacher’s unit plan is that discussions with the teachers about their teaching were strengthened. Unit plans are easily accessible and contain an
large amount of “high-quality information” to help verify the semi-structured interview responses (Sarantakos, 2013, p. 313).

The interview data was entered into NVivo 8 and pattern coded to establish the identification of emerging themes. The lesson plans were analysed using a PCKgft model developed by the researcher (see Figure 9). The model was populated with information from the teachers’ unit plans and linked current practice with ideas about teaching components of technological food literacy.

3.6 Legitimation

In mixed methods research, Cohen et al. (2011) argue the case for identifying specific research project requirements to overcome validity perspectives of mixed methods research. Cohen et al. (2011) consider that these validity perspectives are overcome by using Onwuegbuzie and Johnson’s (2006) legitimation framework. Mixed methods research identifies the term “legitimation” as an alternative description for determining validity and reliability in mixed methods research studies (Cohen et al., 2011; Onwuegbuzie & Johnson, 2006). It involves assessing the trustworthiness of both the qualitative and the quantitative data and the interpretations that result (Johnson & Onwuegbuzie, 2004). Usually with mixed methods research, the weakness of one method (e.g., qualitative) is compensated by the strengths of the other method (e.g., quantitative) (Onwuegbuzie & Johnson, 2006). Legitimation is not seen as an outcome, but an iterative process that occurs throughout all stages of mixed method research, be it qualitative or quantitative in nature (Ihantola & Kihn, 2011). The validity perspectives relevant to this study will now be discussed.

3.6.1 Sample integration

Sample integration is described as how different sample kinds and sizes used in combination with each other in mixed method research can enable high-quality inferences to be made (Cohen et al., 2011; Onwuegbuzie & Johnson, 2006). This is of particular importance when “a researcher wants to make statistical generalizations from the sample participants to a larger target population” (Onwuegbuzie & Johnson, 2006, p. 56). It is regarded as essential to consider the way individuals or groups have been selected (Onwuegbuzie & Johnson, 2006) so inferences can be made. The threat exists when different individuals are involved in the qualitative and quantitative phases of a project (Ihantola & Kihn, 2011) and the researcher wishes to draw inferences between the phases and across sampling groups.
In this research, the samples were “nested” inside each other; that is, the participants who volunteered their contact information with the anonymous questionnaire were invited to participate in the focus groups, who were then asked and invited again to teach a unit of technological food literacy. The Delphi experts were used for the interviews and the two successive Likert scale questionnaire rounds. The individual sampling decisions for each phase will now be considered.

In this research phase, purposive sampling methods were used for the Delphi, in which 24 experts from a range of food-related fields were interviewed. This sample size falls within the range Hasson et al. (2000) suggest is required to provide adequate representation. The same individuals were used in both the qualitative and the quantitative components of the study at this stage (Onwuegbuzie & Johnson, 2006), which permitted inferences to be drawn from both components of the study.

The focus groups’ sample size was based on an invitation to 10–12 participants who had indicated they would consider being involved in the research. This group size was in accordance with the advice of Morgan (1998) and Krueger (1994), who indicate that focus groups are best when they contain between six and 10 participants.

The teaching intervention study sample size was based on “typicality” (Merriam, 1998), which was considered useful to generate hypotheses about what might work when teaching with a components of technological food literacy framework. Teachers were active and experienced in teaching food technology curricula in New Zealand schools at Years 8–10 level.

### 3.6.2 Inside–outside views

The legitimation threat of inside-outside views refers to researchers having to balance their views as both an insider (or “emic” researcher) and an outsider (or “etic” researcher) throughout the mixed methods research process (Cohen et al., 2011). Tensions exist because quantitative research often seeks an objective, “standing on the outside looking in” view, yet qualitative data seeks the interpretation of the researcher “on the inside, looking out” (Ihantola & Kihn, 2011; Onwuegbuzie & Johnson, 2006). The threat exists if the viewpoints are not fully in balance. There is a reliance on the researcher to maintain a balanced perspective in “describing and explaining the research process” (Cohen et al., 2011, p. 198) and “when collecting, analyzing and interpreting what the whole set of … data means” (Onwuegbuzie & Johnson, 2006, p. 58).
In this research, good practice was maintained throughout the research process so as to remain objective as outlined below:

- When the qualitative data was collected, analysed and interpreted, certain protocols were followed. The anonymous questionnaires and contact details were submitted away from the researcher so that all data was provided in a manner that protected people’s privacy.
- The qualitative data was analysed using NVivo 8 coding to develop themes based on the data collected.
- To establish the reliability of the interview data, Cohen’s kappa statistic was calculated. This indicated the level of agreement between two sets of scores.
- Themes developed from the data analysis informed the findings and conclusions of the research (Merriam, 1998).
- Quantitative analysis was completed with the use of standardised tools, SPSS and Excel.
- Research procedures and analysis calculations, particularly for the Delphi Likert scale questionnaire rounds, were established prior to any data collection.
- Semantics play an important role in the development of a scale (Lam & Kolic, 2008) and the wording of the Likert scales was carefully developed.
- Linstone and Turoff (1975) assert that the Likert scales must also have a carefully defined rating scale to provide a reasonable degree of assurance that the individuals make compatible distinctions between concepts. The rating scale was also carefully developed to reflect this. By using the same rating scale for each suggested component, it was hoped that an accurate measurement of the perceptions of these experts about the component would be gained and that this would contribute to an overview of the programme as a whole.

### 3.6.3 Weakness minimisation

Weakness minimisation legitimation refers to the weakness of one approach being compensated by the strengths in the other in the research (Ihantola & Kihl, 2011; Onwuegbuzie & Johnson, 2006).

The Delphi stage of the research was planned carefully so any identified weakness in the original, first-collected qualitative data from the semi-structured interviews could be complemented by the quantitative analysis of the Delphi, thus strengthening the development of the components of technological food literacy. Care was taken to identify experts in the Delphi that were “typical” of the food concepts that were being researched (Merriam, 1998). By using experts from eight different categories and four different concepts of food, this research
endeavoured to use “typical food experts”. Quantitatively, all aspects of calculations and reduction of the components of technological food literacy as the Delphi Likert scale questionnaire rounds progressed were recorded so as to create links between the data and the findings, and create a level of dependability so that the “instrumentation, data and findings should be controllable, predictable, consistent and replicable” (Cohen et al., 2011, p. 201). Foods teachers from a range of schools and teaching expertise were invited for the focus group phase so a representative grouping of foods teachers was obtained.

### 3.6.4 Sequential

Sequential legitimation refers to minimising any “meta-inferences” that might be created if the sequencing of the qualitative and quantitative phases of the research project were reversed (Cohen et al., 2011; Onwuegbuzie & Johnson, 2006). A meta-inference is described as “an overall conclusion, explanation or understanding developed through an integration of the inference obtained from the qualitative and quantitative strands of a mixed methods study” (Tashakkori & Teddlie, 2008, p. 101). In the process of drawing interpretations and conclusions from the data, it was important to clearly distinguish between the ideas generated from making meaning from the data and the data quality – the attributes that went into the making of the meaning.

The sequential explanatory strategy was employed for the Delphi Likert scale questionnaire round and weight was given to the quantitative data results, informing the next qualitative data collection (Creswell, 2009). This design was chosen to broaden the dimensions of the project and allow space for any unexpected results from the quantitative analysis to be considered in greater detail in the next qualitative round and, in particular, to provide in-depth reasoning about the development and structure of the components of technological food literacy.

### 3.6.5 Conversion

Conversion refers to using numbers carefully in ways that “produce trustworthy findings” (Ihantola & Kihn, 2011, p. 48). Examples of numbers not being used carefully in research include using verbal cues such as “some” and “a few”, or using numbers inappropriately such as using percentages with small samples and avoiding specifics (Ihantola & Kihn, 2011). This all indicates confusion in the research environment, creating overgeneralisations and unrealistic representations (Onwuegbuzie & Johnson, 2006). Cohen et al. (2011) suggest using numbers in a way that can provide robust inferences from the data.
All participant numbers are provided on the research overview so not as to mislead. Verbal cues are not used in the data, nor are percentages.

### 3.7 Ethical considerations

Ethics approval was obtained for all three data collection phases of this research from the University of Auckland Human Participants Ethics Committee:

- Phase two: 2 December 2011, reference 7705.
- Phase three: 2 December 2011, reference 7712.

Research is a dynamic process. It involves researchers and respondents engaging together in a process underpinned by mutual trust and cooperation, and with the intent to do no harm (Cohen et al., 2011). Every effort should be made to keep participants clear about the intended outset and informed about issues, and for them to give “free and informed consent” to the research process (Sarantakos, 2013, p. 17). Researchers should also “employ accurate methods and analysis”, working accurately and professionally to allow for appropriate and accurate reporting of the findings (Sarantakos, 2013, p. 17). The ethical considerations in this research include informed consent, anonymity and confidentiality, voluntary participation and power relationships and researcher bias.

Each phase considered different ethical principles and these are detailed below.

#### 3.7.1 Informed consent

Key considerations in informed consent are that it be provided in advance of the research taking place and that participants have time to consider carefully the potential consequences of the research (Cohen et al., 2011). Informed consent ensures that all participants are told the details of the research project and what their involvement will entail should they choose to provide consent to participate. Several steps for each phase of the research project were actioned so all involved parties were informed prior to signing their consent form.

In recruiting participants for the focus groups, participant information sheets were placed on the chairs or tables in the conference rooms prior to the commencement of the presentation. There was an audio-visual element to the introduction, which teachers could watch if they chose not to read or fill in the consent forms. Teachers were asked for written consent on a separate document if they were prepared to be contacted to be part of the research.
Food experts were recruited using information that they had placed in the public domain, for example, academic articles or newspaper interviews in which they had disclosed their contact details. Food experts were purposively selected so that they met the expert criteria in one of the five food literacy dimensions discussed in Section 1.3. The food experts were sent a letter requesting an interview and a consent form inviting them to participate in the research project. They were informed in the letter of the nature of the Delphi sequence and that their involvement was not just an interview, but included a commitment to later rounds of the Delphi methodology and involved an approximately three-hour time commitment. Twenty-four experts (from the range of eight different food areas) responded to the letter and returned their consent forms. Subsequently, contact was made by phone or email and a time for the initial interview was established.

Focus group participant teachers were identified from the consent forms submitted during phase one. Teachers were allocated into regions of New Zealand where the numbers were considered adequate to form a focus group (Krueger, 1994; Morgan, 1998) and were sent the “Participant Information Sheet: Focus Group” inviting them to participate in a focus group in their region. Five focus group areas were established, but there was only sufficient interest from participant teachers to hold four focus groups. The information sheet informed them of how the focus group discussion data was to be used as part of the overall research project. The participants were requested to keep their discussions from the focus groups confidential although there was no guarantee that this would occur. They were also informed that because of the nature of focus group discussions their contribution could not be withdrawn from the transcript, but they were able to “pass” in the discussion.

Three teachers indicated their willingness to be involved in the study teaching a component of technological food literacy at focus groups. Six teachers showed an interest initially and all information was sent to their school principal providing them with an overview of the research project and asking for permission to access the classroom on the basis of the information given in the “Participant Information Sheet: Principals” (shown in Appendix H). Consent from the principal to conduct the research within the school was gained via the “Principals Consent Form”. Teachers were informed in the “Participant Information Sheet: Teachers” (shown in Appendix H) that the interviews would be used as part of the overall research project. By completing the “Teachers Consent Form” the participant teachers provided consent. They had the right to refuse participation at the commencement of the interview and could refuse to answer questions during the interview process. It was recognised that conditions could arise that would have prevented them from completing the research process and the teachers had the right
to withdraw completely prior to the teaching of the introduction to the teaching programme that had been planned.

Initially, participating students were told about the project by the teacher and if they showed an interest they were given a copy of the participant information sheet, which asked them to contribute by providing a photocopy of their work. Parents and caregivers were informed in the “Participant Information Sheet: Parents/Caregivers” (shown in Appendix H) as the students were under the age of 16. In addition, students were asked to give their assent. By completing the “Students Assent Form” and “Parents/Caregivers Consent Form” these parties provided consent. If parents chose to not provide consent, the students continued with the work and the photocopied material was destroyed prior to the researcher being given the work. Each teacher had the right to refuse participation at the commencement of the interview and could refuse to answer questions during the interview process. It was recognised that conditions could arise that prevented them from completing the research process and that they had the right to withdraw completely prior to the teaching of the introduction to the teaching programme that had been planned.

All the participants were informed through their respective participant information sheets that the research was a research project for a PhD thesis that would be published and that the risk of confidentiality of identity was minimised through the use of pseudonyms and codes. Time commitments were also indicated on the participant information sheets for each participant group. By informing the participants fully about the purpose of the research and the commitment that was being asked of them, they were being honestly informed about the purpose of the project (Creswell, 2009; Sarantakos, 2013). A chart indicating the participant information sheets and consent forms is provided in Appendix G List of Participant Information Sheets and Consent Forms used within project along with a selection of the participant information sheets.

3.7.2 Anonymity and confidentiality

Anonymity aims to protect the information provided by the participants so their individual identity will not be revealed. It was not possible to offer participants anonymity as they were either part of a small professional community in New Zealand teaching food technology or well-known experts in the food community. Steps were taken to minimise the risk of confidentiality of identity throughout the project. All the participants were informed through their respective participant information sheets that the research was a research project for a PhD thesis that would be published and the risk of confidentiality of identity would be minimised through the
use of pseudonyms and codes. To protect the people’s privacy, the completed questionnaires and consent forms were to be placed in a drop-box at the conference entrance rather than in the conference presentations. Focus groups were asked to keep the focus group discussions confidential to themselves. Student work was anonymised prior to the material being given to the researcher. When a transcriber other than the researcher was used, the transcriber signed a confidentiality agreement. All participants were informed of these steps in their respective participant information sheets.

3.7.3 Voluntary participation and power relationships

All participants were asked to voluntarily contribute to the research project and all potential participants had the right not to take part. With the anonymous questionnaire, at the start of the conference presentation, the teachers’ attention was drawn to the information on their chair. If they did not wish to take part, there was a slide show to watch.

The food experts were invited to voluntarily participate in the research project and all had the right to not take part. They were informed in their participant information sheet about the discursive nature of the project. The participant information sheet clearly indicated the time commitment for each phase of the Delphi and that they had the right to withdraw from the project at any time. Their data could also be withdrawn up to the time that the components of technological food literacy statements were developed for the Likert scale questionnaires.

Focus group participant teachers may have had a sense of being required to answer the questions posed to the focus group. A mechanism to avoid this situation was provided by allowing the teachers the locus of power by permitting a “pass” answer on any question posed in the focus group discussion and being told in the participant information sheet that their participation was voluntary at any stage of the discussion. Data collection was overt by means of open-ended questions in the focus group situation without the use of any deceptive questions.

Teachers trialling a component of technological food literacy had already indicated their interest in participating through the use of consent forms in other studies but they had the right to decline involvement once invited. The principals of participating schools were approached and signalled their knowledge that the involvement of students and teachers was voluntary and that coercion was not to be used to increase their participation.

Teachers may have perceived a risk of overwork due to their assent to work with the research project. Teachers had the right to refuse participation until the commencement of the school term. The intent was to design a teaching unit that the teacher would already be performing in
the course of their normal duties. It was also intended that the interviews and the development of the teaching unit would occur during school holiday times so as to not overload the participating teacher during the school term.

Students could not be coerced into participating by their classroom teacher as the teacher was unaware of who had consented to be involved in the project. The teachers could not place undue pressure on any student or group of students to perform. The students’ anonymity was ensured because of the method of placing the consent form in a locked box in a separate area of the school to the participating teacher in an envelope provided. The student work was to be completed by all students in the class as part of the normal learning of the unit that the teacher was teaching. Sections of the work were copied and submitted to the researcher but an independent person within the school was involved in sorting the student consents and the consented work, and destroying the unconsented.

Some participants in the presentation may have been teaching colleagues of the researcher in the past. Current teaching colleagues at the time were excluded from this project to avoid a conflict of interest or a sense of coercion as the researcher was also a teacher and a head of department in a school.

3.8 Summary

This chapter has outlined the research design for the project. The use of the interpretivist paradigm for this research project has been justified. The use of a mixed methods methodology allowed for the complementary strands of qualitative and quantitative data collection methods to initiate new ways of thinking about educating towards food literacy in the 21st century. The sampling types used and the data gathering methods have been identified and justified. Convenience sampling was used with the anonymous questionnaire and this assisted in identifying teacher participants for the focus group and intervention study. Purposive sampling was used to identify food experts from a range of food concepts. These food experts provided responses to semi-structured interviews and Delphi Likert scale questionnaires. The project has been given legitimation by the consideration of mixed methods methodology, the variety of data collection methods and the analysis, both qualitative and quantitative, of the data collected. The focus group discussion led to the development of a components of technological food literacy model that was then used by intervention teachers. The intervention study presented ideas on how teachers of Year 9–10 food technology visualised incorporating the components of food literacy within their existing units of work. The issues of ethical considerations that affected this
project have been identified and justification of how the researcher aimed to consider these issues within the research design has been presented.
Chapter 4: Findings: Experts’ Perspectives about Food Literacy for Food Education

4.1 Introduction

This chapter reports on the first research question posed to food experts, “What are the attributes of a food literate person?”, in Sections 4.2 and 4.3. In Section 4.4 the phase one semi-structured expert interviews questioned the experts to reflect upon their opinion of personal characteristics of a food literate person and the ideas arising from the interviews are presented. There were a further two Likert questionnaires in the Delphi sequence which were asked of participants to establish what components are deemed essential for a technological food literacy education programme. Section 4.4 indicates the findings of Phase One Questionnaire 1 Likert scale questionnaire and provides an explanation for reaching consensus through the Delphi. Section 4.5 describes the Phase One Questionnaire 2 Likert scale questionnaires. A summary is then presented in Section 4.6. Section 4.7 discusses the investigation into the ideas of these experts conducted to determine whether they could be used to populate the theoretical food technology literacy model, developed at the end of Chapter 2. Sections 4.8. and 4.9 present the analytic tool that was developed to investigate the wording of the components of food technology literacy to see whether there was synergy between these experts’ opinions and the theoretical model. The findings of this chapter are summarised in Section 4.10.

4.2 Food experts’ views

The overall aim of this project was to identify the elements of technological food literacy. However, it was also intended that the characterisations of an “ideal” food literate person would be identified by these experts, and that these would then be developed into a model that reflects the dimensions of technological food literacy and that could be used for food literacy education. To reflect the development of a 21st century technologically food literate person, it was expected that these characterisations would be supported by the teaching of these components in a technological food literacy education programme.

The following research questions, which were initially identified from the food expert interview responses, were posed to identify the attributes of a food literate person:

- What are the attributes of a food literate person?
- What components are deemed essential for a food literacy education programme?
The interviews were initially qualitatively analysed using NVivo 8 with a pattern coding system (Miles & Huberman, 1994, p. 69) in which emerging common themes were identified.

4.3 Interview ideas

The initial interview questions to the experts provided the first round of the Delphi. The experts are defined in Appendix A Defining the experts. The questions reflected upon their opinion of personal characteristics and were as follows:

- Tell me about your involvement with food.
- What do you think are the important concepts that our future students need to know about food?
- Why do you regard these concepts as important?
- What is your wish-list of personal skills that a food literate 21st century citizen would possess?
- Why do you regard these skills as important for the future?

From the interview data, lists of statements \( (n = 627) \) were generated from open-coding the comments using the NVivo programme. It was intended that these attributes of a food literate person gained from the interview data would be developed into a food literacy model that could be further developed for teaching.

A 20\% \( (n = 127) \) sample of these statements was generated using the Excel random number formula. These comments were recoded by an independent researcher (rater) using the same coding rules. To verify the validity of the coding from the interview data, a Cohen’s kappa statistic calculation was conducted. The kappa statistic measures the reliability of the coding by measuring the agreement between the two raters, subtracting out agreement due to chance. This process indicates the statistical reliability of the kappa statistic being true over all the data collected or if the survey was to be repeated. The inter-rater reliability for all values was found to be kappa = 0.753 \( (p < 0.000) \), 95\% CI \( (0.7020, 0.8040) \). Kappa = 0.753 indicates a substantial level of agreement between the two raters, with a 95\% CI between the two raters being narrowly ranged between 0.7 and 0.8, indicating the estimate of agreement to be precise and that the data appears to be statistically reliable.

A pattern coding system was used to determine common themes. These themes were in four categories; within which there were 18 subthemes identified. The identified themes and subthemes are indicated in Table 5. These are in ‘short-hand’ form, adopted for coding purposes.
Table 5. Themes and subthemes of an ‘ideal’ food literate person from expert interviews

<table>
<thead>
<tr>
<th>Themes</th>
<th>Subthemes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disposition</td>
<td>Innovative</td>
</tr>
<tr>
<td></td>
<td>Authentic</td>
</tr>
<tr>
<td></td>
<td>Motivation</td>
</tr>
<tr>
<td></td>
<td>Compulsory</td>
</tr>
<tr>
<td>Knowledge</td>
<td>Culture</td>
</tr>
<tr>
<td></td>
<td>Food systems</td>
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<td></td>
<td>Science</td>
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<td></td>
<td>Nutrition</td>
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<td></td>
<td>Origins</td>
</tr>
<tr>
<td>Skills</td>
<td>Critical thinking</td>
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<tr>
<td></td>
<td>Financial</td>
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<tr>
<td></td>
<td>Hygiene</td>
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<tr>
<td></td>
<td>Innovation</td>
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<td></td>
<td>Shopping</td>
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<td></td>
<td>Tasting</td>
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<tr>
<td></td>
<td>Cooking</td>
</tr>
<tr>
<td></td>
<td>Learning</td>
</tr>
<tr>
<td>Food as a career</td>
<td>Career pathways</td>
</tr>
</tbody>
</table>

Similarity in comments from the experts determined a coding rule to be applied to all interview data (see Appendix H Coding rules for Expert Interview Data). The theme ‘Disposition’ referred to comments that were regarded as a motivation or an innovation. The theme ‘Knowledge” referred to comments that referred situations where information or knowledge was applied. The theme ‘Skills’ referred to where skills were practiced or applied. Statements were then developed from the coded statements, which were then presented back to the experts in Questionnaire 1. As an example, for the disposition subtheme “Innovative”, examples of the experts’ quotes that informed the category were:

“creativity... just trying new flavours and what goes with what and having the confidence to throw things together, the creativity and the confidence to try new things, new flavours.”

“I think you can be creative, I think creativity and innovation is the way of the future ...”

“they need to be adventurous and willing to try new things.”

4.3.1.1 The “Compulsory” subtheme

An additional category was evident from the interview open-coding that indicated that food education should be accessible to all. Comments from the food experts that supported this position included:
“food education should be for everyone, from an early age ...”

“...Well, we’d start off with exposure to food in all primary schools and that’s because a lot of people don’t prepare foods in the home, and simply creating attitudes of awareness around food ... it should be a basic requirement ... no matter whom they are or what they are or where they go to school.”

“There should be a core generic awareness around food that is offered, everyone participates in the programme.”

As this was not a characteristic of a food literate person but a generalisation about food education, the decision was made that this category would be not submitted in the Delphi sequence. However this idea of food education being accessible to all has the potential to inform the overarching nature of a food literacy education programme.

4.4 Phase One Questionnaire 1 Likert in the Delphi Sequence

The second round of the Delphi involved the 17 remaining subthemes being returned to the experts as Phase One Questionnaire 1 Likert in the Delphi Sequence (see Appendix E Phase One Questionnaire 1 Likert in the Delphi Sequence) to rate the subthemes on their essentiality in a food literacy education programme.

The Phase One Questionnaire 1 Likert format was chosen to first establish whether the participant experts felt that the components corresponded to their views of essential components of a food literacy education programme. It was hoped the use of an essentiality scale in a Likert scale questionnaire (Phase One Questionnaire 1 Likert in the Delphi Sequence) would identify this. The focus for the rating scale was on how essential each component mentioned was to a 21st century food literacy education programme. The food experts were asked to reflect on the subtheme ideas as an aspect that could be taught in a food literacy education programme and determine how essential they thought each category would be. The experts could comment about why they thought that way if they wished.

The question posed to these experts was:

“How essential do you think the following components are in a food literacy education programme?”

And the categories offered for ranking on a Likert scale were:

1. Innovation with food
2. Food preparation from scratch
3. Self-motivation, curiosity and confidence
4. Knowledge of the cultural dimension and significance of food
5. Knowledge of the systems that underpin food
6. Knowledge of scientific interactions in food
7. Knowledge of health-giving properties of food
8. Knowledge of the origins of food
9. Critical thinking and decision-making about food
10. Application of financial knowledge to food purchasing decisions
11. Food hygiene
12. Skills of innovation, experimentation and development of food
13. Menu planning and food purchasing decisions
14. Sensory experience of food
15. Application of cookery skills
16. Use of literacy and numeracy skills
17. Knowledge of food-based career opportunities.

The Likert scale questionnaire design followed the ideas of Likert (1932) and Lam and Kolic (2008) and a matched, equal interval positively packed label scale was created in which “slightly essential” was viewed as the midpoint. An example of the questionnaire used is shown in Figure 2 (see Appendix E Phase One Questionnaire 1 Likert in the Delphi Sequence for full questionnaire).

![Figure 2. Excerpt from Phase One Questionnaire 1 Likert in the Delphi sequence](image-url)
The intent of the rounds in the Delphi is to gain the convergence of expert opinion on the predictions that are given (Hill & Fowles, 1975). Powell (2003) comments that there appears to be “no firm rules for establishing when consensus is reached” (p. 379) in the Delphi sequence and that understanding the mechanism used to establish consensus is often not mentioned in studies. Murphy et al. (1998) consider how consensus is reached and indicate that mechanisms used to aggregate scores may be open to arbitrary decision-making by the researchers. It was intended that the results of Questionnaire 1 Likert (see Appendix E Phase One Questionnaire 1 Likert in the Delphi Sequence) would provide a response to the quantitative research question posed for this stage of the research:

“What statistical evidence will show that some components of food education were deemed more essential than others?”

4.4.1 Reaching consensus

Consequently, the frequency of the responses (mode) was checked. As the data was categorical, the mode could indicate the most common value chosen by the experts in their rating of the components of a food literacy education. As the location of the mode in data can be atypical of the data set, the concentration of the data was also calculated to see the range within which most of the rankings fell: between 1 and 2, 2 and 3, 3 and 4, or 4 and 5.

The analysis of the Phase One Questionnaire 1 Likert was conducted using the mode, and where the rankings banded together with greater frequency on the rating scale. It was intended that the five lowest-rated components for both the mode and the frequency would be removed from the Phase One Questionnaire 2 Likert. The lowest components fell below 3.5 and were removed. This led to the 12 categories being submitted back to the food experts for their consideration. The statements were reviewed and revised in view of the comments provided by the experts.

4.5 Phase One Questionnaire 2 Likert in the Delphi sequence

The purpose of the third Delphi round (see Appendix F: Phase One Questionnaire 2 Likert in the Delphi sequence) was to move to consensus on each of the statements. Linstone and Turoff (1975) indicate that the range between the experts’ views lessens with each round. The guiding question was posed:

“To what extent do you agree that this component is absolutely essential in a food literacy education programme?”
During this round, the expert panel were able to see selected comments and responses from previous rounds related to the 12 top-rated statements. This was done to enable them to reflect on their own response and the relationship of their own response to the rest of the experts. Hill and Fowles (1975) indicate that this method is a way to elicit consensus and facilitate agreement rather than compel the experts to agree with each other by ignoring their input if they fall outside the bounds of central tendency.

These experts were then asked to re-evaluate each (revised) subtheme and make a decision to rate the component on essentiality. The categories offered were:

1. Food preparation from scratch
2. Self-motivation, curiosity and confidence
3. Knowledge of cultural dimension and significance of food
4. Knowledge of systems that underpin food
5. Knowledge of health-giving properties of food
6. Critical thinking and decision-making about food
7. Application of financial knowledge to food purchasing decisions
8. Food hygiene
9. Menu planning and food purchasing decisions
10. Sensory experience of food
11. Application of cookery skills
12. Use of literacy and numeracy skills.

The Likert scale in the Phase One Questionnaire 2 Likert offered a five-point scale with a neutral point. Linstone and Turoff (1975) suggest that a four-point Likert scale offers the minimum information for an adequate form of evaluation to take place (see Appendix F Phase One Questionnaire 2 Likert in the Delphi sequence for full questionnaire). A four-point Likert scale will also allow one person to think that an invalid item is important when others may believe it to be true (Linstone & Turoff, 1975). Linstone & Turoff (1975) also comment that the opportunity for neutral answers should not be provided, as a neutral answer provides very little information, and consider that this is a way to think out the issue and force the respondent to take a non-neutral stance. The Likert scale used did offer a neutral point, but the experts were still required by the email programme to provide a rationale for their rating. The excerpt of the questionnaire used is shown in Figure 3.
Figure 3. Excerpt from Phase One Questionnaire 2 Likert in the Delphi sequence

A selection of the respondents’ comments about the component from the Phase One Questionnaire 1 Likert headed the section to assist the experts in making a response. Space was provided for comments, clarification or discussion on each category suggested.

4.5.1 Reaching consensus

The third round was analysed similarly to the Phase One Questionnaire 1 Likert by using the mode and ranking bandings. There was a clear gap (mode less than 3 for the final 10 components of food literacy chosen). There was a statistically strong pattern shown for the first three components of “Food hygiene” (FH), “Application of cookery skills” (CS) and “Food preparation from scratch” (FP), which had a mode greater than 4.3, indicating that the experts felt these components were regarded as absolutely essential attributes of a food literate person. The next four components – “Use of literacy and numeracy skills” (L&N), “Sensory experience of food” (SE), “Menu planning and food purchasing decisions” (MP) and “Knowledge of health-giving properties of food” (H) – held a mode banded between 4.0 and 4.2. The final three components – “Cultural dimension and significance of food” (Cu), “Systems that underpin food” (Sy) and “Critical thinking and decision-making about food” – (CT) held a mode banded between 3.4 and 3.95.

As a result, two statements – Self-motivation, curiosity and confidence and Application of financial knowledge to food purchasing decisions - were eliminated at this stage and consensus was achieved.

The comments from the experts also helped to clarify their thinking behind the ranking of the components. The component “Food hygiene”, which was ranked highest, has examples as
follows of the experts’ comments, which helped to underpin and inform the researcher about the importance they placed on the ranking choice. They commented:

“A vital life skill. Many are affected by foodborne illnesses which is so preventable.”

“A component of food safety – affects us all.”

“Is a key aspect regardless of what the purpose of the course is.”

“One of the most critical areas in food.”

### 4.6 Identifying the final components

The final components of food literacy and their suggested definitions are indicated in Table 6. The initial theme and subtheme from Table 5 is identified in the first column descending the left-hand side of the page. The name for each component of food literacy is identified in red typeface in the second column descending the page. The initial phrase of the definition of each component reflects the original themes that these experts identified, that is, that the nature of the component was a disposition, a knowledge or a skill base. The central aspect of the definition references to the component and the final section of the definition provide some guidance as to how the component may be enacted.

A generic example of this is indicated in Figure 4.

<table>
<thead>
<tr>
<th>Theme and Subtheme</th>
<th>Component of Food Literacy</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Skills- Hygiene</td>
<td>Food hygiene</td>
<td><strong>The practice and application of skills with food that a 21st century food literate person may display include food hygiene – the application of food hygiene rules and guidelines.</strong></td>
</tr>
</tbody>
</table>

Figure 4. *Exemplar of component of food literacy definition*

Colours have been added to each aspect to assist with identification of these parts in Table 6.
<table>
<thead>
<tr>
<th>Theme and Subtheme</th>
<th>Component of Food Literacy</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disposition – Authentic</td>
<td>Food preparation from scratch</td>
<td>The disposition or personal characteristics or mannerisms that a 21st century food literate person may display include an ability to be innovative and try things, for example, try a new food, work without a recipe, be authentic, e.g., prepare food for a real family.</td>
</tr>
<tr>
<td>Knowledge – Culture</td>
<td>Knowledge of the cultural dimension and significance of food</td>
<td>The knowledge or literacy skills that a 21st century food literate person may display include the knowledge of culture knowing the role that food plays in the rituals and practices of particular groups in a society, an ability to recognise that food has an importance to oneself, and that food has a cultural dimension and significance.</td>
</tr>
<tr>
<td>Knowledge – Food systems</td>
<td>Knowledge of the systems that underpin food</td>
<td>The knowledge or literacy skills that a 21st century food literate person may display includes the knowledge of food systems – the systems that underpin our food such as growing, distribution, retail, additives, processing, food labels.</td>
</tr>
<tr>
<td>Knowledge – Nutrition</td>
<td>Knowledge of health-giving properties of food</td>
<td>The knowledge or literacy skills that a 21st century food literate person may display include the knowledge of nutrition – the study of the health-giving properties of our food.</td>
</tr>
<tr>
<td>Skills – Critical thinking</td>
<td>Critical thinking and decision-making about food</td>
<td>The practice and application of skills with food that a 21st century food literate person may display include critical thinking – being able to think wider and deeper about food and act on that knowledge.</td>
</tr>
<tr>
<td>Skills – Hygiene</td>
<td>Food hygiene</td>
<td>The practice and application of skills with food that a 21st century food literate person may display include food hygiene – the application of food hygiene rules and guidelines.</td>
</tr>
<tr>
<td>Skills – Shopping</td>
<td>Menu planning and food purchasing decisions</td>
<td>The practice and application of skills with food that a 21st century food literate person may display include shopping skills – the practice and application of shopping skills to the purchasing decisions about food.</td>
</tr>
<tr>
<td>Skills – Tasting</td>
<td>Sensory experience of food</td>
<td>The practice and application of skills with food that a 21st century food literate person may display include tasting – experiencing food in a sensory way, knowing how foods should taste.</td>
</tr>
<tr>
<td>Skills – Cooking</td>
<td>Application of cookery skills</td>
<td>The practice and application of skills with food that a 21st century food literate person may display include cooking – the application of cookery skills to food.</td>
</tr>
<tr>
<td>Skills – Learning</td>
<td>Use of literacy and numeracy skills</td>
<td>The practice and application of skills with food that a 21st century food literate person may display include learning – in possession of basic numeracy and literacy skills.</td>
</tr>
</tbody>
</table>

### 4.7 The next step

A stance that food is a technological outcome was presented in Section 2.2. As a result, a theoretical food technology literacy model was developed from the literature review and this is shown in Figure 1. This premise provides the opportunity for the context of food literacy to be viewed from the perspective that food is a technological outcome and Section 4.8 shows how this data analysis is carried out.
A further research question investigated “What components did food experts deem essential for a food literacy education programme?” in Section 4.5. It is important to determine whether the views of the food experts matched with the concepts identified in the theoretical frame that underpins this research. A table of suggested components of technological food literacy concluded this research question (see Table 6). The following section further develops the theoretical food technology literacy model with the essential components of food literacy views from the food experts. An analysis comparing the wording of the suggested components of technological food literacy and the theoretical food technology literacy model is presented. This is to confirm that the populating of the theoretical food technology literacy model has been matched with the underpinning literature that informed the development of this model. In Section 4.9, the populated food technology literacy model (see Figure 6) that takes into consideration this analysis is presented. The conclusion of this chapter is then presented in Section 4.10.

4.8 Developing the populated food technology literacy model

Earlier in this chapter a research question investigated “What components did food experts deem essential for a food literacy education programme?” This resulted in 10 components of technological food literacy being identified and they are described in Table 6.

At this stage, the ideas of these experts needed to be investigated to determine whether they could be positioned within the populated food technology literacy model. An analytic tool was developed that aimed to investigate the wording of the components of technological food literacy to see whether there was synergy between the experts’ opinions and the theoretical model. The purpose was to determine whether the theoretical model was workable when applied to other situations rather than being just a reiteration of the literature.

The analytical tool for the food technology literacy model analysis was developed by identifying the significant phrases in the food technology literacy model – particularly those that informed the development of the model. Key words and phrases originated from the literature search. Firstly, those from the Giessen Declaration (Beauman et al., 2005) and, secondly, those from seminal works regarding the concept of technology. These key words were then used as search terms to review the ideas of the food experts. In the final round of the Delphi, the ideas of these experts were summarised and used as key ideas to inform the suggested definitions of each component of food literacy. These key ideas and the resulting definitions were searched for similarities of the key words and phrases originating from the wording of the literature review. Coding the key words in this way revealed that the ideas of the components of technological
food literacy could be located within the populated food technology literacy model. These phrases are indicated by the typed phrases that progress down the left side of the analysis framework. The colour coding of each dimension of the populated food technology literacy model assists to indicate the types of the ideas: the key phrases do not sit neatly within one area of the model, but can be of an integrated nature, as indicated in the literature. The ideas of greater emphasis are shown by the use of bold coloured typeface.

A generic example of the approach used in this analysis, which indicates the first Giessen dimension of social dimension within this framework, is shown in Figure 5.

<table>
<thead>
<tr>
<th>Literature Search Words</th>
<th>Component of Technological Food Literacy – key phrases from experts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Social Dimension</td>
<td>Food Hygiene:</td>
</tr>
<tr>
<td>The interaction of food and food…</td>
<td>- know and apply food hygiene rules</td>
</tr>
<tr>
<td></td>
<td>- guidelines to keep food safe</td>
</tr>
<tr>
<td></td>
<td>- critical area – affects all health</td>
</tr>
<tr>
<td></td>
<td>- underpins all</td>
</tr>
</tbody>
</table>

Figure 5. The analytic tool – a generic example – moving from the theoretical to a populated food technology literacy model

This analysis determined whether and where each component of technological food literacy could be situated within the populated food technology literacy model.
Table 7. Populating the populated food technology literacy model—key phrases from the experts (Giessen and Mitcham) that align with essence statements that have been informed from literature

<table>
<thead>
<tr>
<th>Essence Statement Descriptors for Sections of the Food Technology Literacy Model</th>
<th>Components of Technological Food Literacy – Key Phrases from Experts</th>
</tr>
</thead>
</table>
| **Social Dimension**<br>The interaction of food and food cultures with issues that affect the sustenance and happiness of humans. | **Food Hygiene:**<br>Know and apply food hygiene rules<br>Guidelines to keep food safe<br>Critical area—affects all health<br>Underpins all of us<br>**Cultural dimension and significance of food:**<br>Roles and rituals with food<br>A way cultural groups communicate<br>Sense of purpose to food<br>There’s more to food than just eating it<br>**Systems that underpin food:**<br>Marketing<br>Food packaging<br>Food labels<br>Know what is in your food before you eat it<br>Preservation of food<br>**Food Hygiene:**<br>Cross-contamination<br>Food supply contamination<br>**Health:**<br>What gives health in food and what doesn’t<br>Healthy eating patterns<br>Healthy lifestyles<br>Health problems<br>Managing our food intake<br>**Systems that underpin food:**<br>Additives<br>Food processing<br>**Environmental Dimension**<br>The cultivation, conservation and depletion of living and physical resources resulting from environmental and ecosystem change. The influence of the food manufacturing, retail and distribution systems. |**Systems that underpin food:**<br>Growing<br>Distribution<br>Retail<br>Production<br>**Cookery skills:**<br>Applying cooking skills to food<br>Skills for basic food preparation<br>Skills practised and competency gained

**Biological Dimension**<br>The personal and population health nutritional status that influences and affects the personal health, nutrition adequacy and well-being of people.

**Environmental Dimension**<br>The technological activity—what comprises …

How things happen in our world which produces technological artefacts. This activity utilises …
<table>
<thead>
<tr>
<th>Essence Statement Descriptors for Sections of the Food Technology Literacy Model.</th>
<th>Components of Technological Food Literacy – Key Phrases from Experts</th>
</tr>
</thead>
</table>
| **Technological Knowledge**  
Practical ideas, the making and using of food artefacts *and*  

| **Use of literacy and numeracy skills:**  
Have basic literacy and numeracy skills  
Read food labels  
Interpret recipes  
Understand how to apply skills to food  

| **Sensory experience of food:**  
**Know how food should taste**  
Food is a nutrition and a sensory experience  
**Develop tastes at a young age**  
Know about ingredients and flavours  

| **Menu planning and food purchasing decisions:**  
**Shopping skills to purchase “good” food**  
**Budget skills learned**  
**Essential basic skill**  
**Used for health management**  
**How to spend money**  

| **Food preparation from scratch:**  
**Innovation**  
**Trying new things**  
**Authentic situations**  
Learn about ingredient action by doing  

| **Critical thinking and decision-making about food:**  
**Wide and deep thinking**  
**Making decisions**  
**Acting on decisions**  
How to make “right choices” about food  
**Innovation fostered and products developed**  

The initial development of the theoretical food technology literacy model considered the information contained within the Giessen Declaration (Beauman et al., 2005) and Mitcham’s (1994) philosophical viewpoints about technology. This section investigated if the ideas of the food experts identified in Chapter 4 (see Table 6) could populate the theoretical food technology literacy model. Ideas about the content of each component of food literacy have been considered and have been overlaid with the ideas expressed in the literature about food and technology.
These are indicated in Table 7. This populated food technology literacy model is used to show how these ideas fit. It was important to consider whether the ideas of the experts could be placed within a theoretical model as this takes the ideas forward towards an idea in which the conceptual frame can be populated with views from food experts.

A key word search was conducted by the researcher to determine whether the descriptive statements from the experts and the key words that contributed to the development of the theoretical food technology literacy model (see Figure 1) identified from the literature review search held commonalities. Each component of technological food literacy will now be discussed in turn. Phrases from the initial interviews with the food experts will be provided to support the development of these links. The comments indicated in this section have been anonymised in accordance with the Delphi methodology and so no quotes in the following section are attributed to the individual experts. To conclude this section, the populated food technology literacy model (see Figure 6) populated with this information, will be presented.

**Food preparation from scratch (FP)**

The food experts identified that encouraging students to develop the disposition to appreciate the challenge and satisfaction of preparing food for themselves and others to share was important. The food experts emphasised the importance of food preparation from scratch, that is, from the combining of raw ingredients to produce a food item, rather than the assembly of a food item from a combination of pre-prepared food items:

“I think teaching people basic cooking skills and how to use raw ingredients and make food that tastes good and how to make inexpensive meals.”

“We have to keep the hands on stuff. It’s the basic knowledge, of having a knowledge bank. Like you know, if what you could make, like you know how to make an omelette from eggs. Or pancakes …”

“If you teach them how to boil potatoes then you are giving them skills for life.”

This indicated to the researcher that the component Food preparation from scratch (FP) was an aspect of technological knowledge in which the ideas of practical involvement and the making of a technological food item are encouraged.

**The cultural dimension and significance of food (Cu)**

When exploring the components of technological food literacy, the food experts recognised that there was a cultural element to the study of foods. They were particularly interested in the opportunities for students to recognise that food was an integral part of the daily rituals and
routines of life and the way that a cultural dimension of a person’s heritage could be expressed. One commented:

“*When you look at the cultural and physiological function that cooking and food plays with human beings, it’s intricate and complex because food is not just about eating. It’s used for all sorts of other things in society … communication, symbolism, tradition: it’s all sorts of things.*”

The Giessen Declaration (Beauman et al., 2005) also expresses the importance of social systems and identifies many social aspects of food, including how food contributes to the happiness of humankind. As a result, the cultural component was attributed to the social dimensions’ aspect of the populated food technology literacy model.

*The systems that underpin food (Sy)*

The food experts identified particular food systems or components within those food systems particularly referring to

“*the development of food supply including nationally and globally.*”

“*Knowledge of the systems that underpin food production, distribution, advertising, gardening and marketing …*”

“The ability to read labels.”

Further guidance can be provided by the in-depth examples provided within the Giessen Declaration (Beauman et al., 2005). The Giessen Declaration (Beauman et al., 2005) is very clear about the influence of systems and their involvement with the food world. Indeed, the Giessen Declaration identifies the social, biological and environmental systems as the dimensions that underpin nutrition in the modern age and provides clear examples of each system and how they can potentially interact with and within each other in the food world (Beauman et al., 2005). This provides a much broader base from which to explore the issue of food in modern societies and it is proposed that it should be considered when reviewing the ideas of the food experts and the ideas as incorporated in the populated food technology literacy model.

The Giessen Declaration (Beauman et al., 2005) provides many examples of social systems that can influence the food approaches that people adopt. This can range from an acknowledgement of income disparities to poor governance of countries or to an individual adoption of new eating patterns as a result of lifestyle or other choices. It is appropriate that the component “Systems” consider these social aspects of food as well.
The biological systems approach identified in the Giessen Declaration particularly refers to the systems that influence and affect the “interactions of health and disease” and relate to “improving the health in humans” (Beauman et al., 2005, p. 783). As this is an example of a health system underpinning food production, it is appropriate the component “Systems” is included in the biological systems dimension of the populated food technology literacy model.

Finally, the environmental dimension of the Giessen Declaration provides examples of systems that particularly interrelate with the production of our food supply. These include the loss of fresh water and the depleted nature of the living and physical resources on earth, as well as the manufacturing of food supplies. The Giessen Declaration also states that “how food is grown, processed, distributed, sold, prepared and consumed is critical … to its effects on … the environment” (Beauman et al., 2005, p. 784). These systems could be considered valuable learning opportunities for students to investigate and so the component Systems that underpin food (Sy) is included under the environmental dimension on the populated food technology literacy model.

**Health-giving properties of food (H)**

In identifying the component Health-giving properties of food (H), the food experts felt it was important that students were given information about the nutritional qualities of food and how they can affect their health and well-being. The Giessen Declaration also recognised that the health aspect of food was important and identifies it as a “classical biological dimension … that is and will remain central” (Beauman et al., 2005, p. 783). The food experts identified that food has health-giving properties that link directly to defining statements of the biological dimension in the Giessen Declaration (Beauman et al., 2005), which include consideration of the aspects of personal health, including obesity, metabolic systems and genomics, as well as those of population health. Their comments included:

“Knowing how to create good health, but understanding that everyone is different.”

“Learn that pleasure and nutrition are two completely separate things we get from food.”


“All students should have the opportunity to learn how to feed and fend for themselves ... in a healthy way for their sustainability in life.”

As a result, the component Health-giving properties of food (H) is located in the biological dimension of the populated food technology literacy model.
**Critical thinking and decision-making about food (CT)**

When the food experts identified this component, they wanted the students to be empowered to be able to think critically about food information and then to be able to make decisions based on that information. The experts commented:

“Learning to question too, I think is very important, that they can look critically at the way in which food is advertised, the way in which it’s marketed, and what’s in it, like in the millions spent on advertising fast food.”

“it’s basically assessing the information, validity of information in a world where information is hugely available.”

Placement of this component in the populated food technology literacy model was linked to technological volition. Technological volition is the mode through which knowledge about the physical world is used by humans to design products, processes and/or systems. Because of volition, an action may be undertaken as the result of the decision-making process about an aspect of food. The researcher married volition with the ideas the experts held about the skills of critical thinking and decision-making about food.

**Food hygiene (FH)**

The component of Food hygiene (FH) has been located in the populated food technology literacy model in each of the systems at the top – that is, social systems, biological systems and environmental systems (see Figure 6). The reasoning for this placement is as follows.

The Giessen Declaration indicates that food systems are shaped by the interactions and relationships between each system (Beauman et al., 2005, p. 784). Trying to locate the component Food hygiene (FH) within one singular system was difficult and indicates a level of complexity and multiple dimensions within the theoretical food technology literacy model.

During the Delphi sequence, the food experts indicated that skills concerning food hygiene rules that applied during the food preparation, storage and service stages should make up an important aspect of a student’s technological food literacy. One commented that people needed to know the guidelines of food safety, particularly

“knowing what they are [the food hygiene guidelines] and how to handle food regardless of who they are and what they are or where they are preparing it ... food-borne illness and contamination can generate illness and this can be a major problem.”

The phrases mentioned by this expert interrelate with the different social, biological and environmental systems of food as well as it being a technological activity. Therefore, the
component Food hygiene (FH) is located in all dimensions of the populated food technology literacy model. The reasoning for this is described below.

The Giessen Declaration, when describing social systems that affect nutrition, refers to “interrelated deprivations that make … life difficult” (Beauman et al., 2005, p. 785). Included in their list of examples of these deprivations is the loss of skills. The food experts referred to the need for students to understand the need for personal and food hygiene routines to be completed skillfully so they did not make each other sick. If students did not understand these routines or how to complete them, there was the potential for illness, which could make life difficult. As a result, the component Food hygiene (FH) has been placed within the social dimension.

Biological systems definitions in the Giessen Declaration refer to “the interactions of health and disease” (Beauman et al, 2005, p. 783), “improving health in humans” (Beauman et al., 2005, p. 783) and “personal health” (Beauman et al, 2005, p. 784). These food experts reasoned that students needed to be aware of cross-contamination and the principles of contaminating the food supply and how to keep food safe for consumption. Because of the need to understand microbiology and the role it plays in keeping food safe, food hygiene was also located within the biological dimension on the populated food technology literacy model.

Discussed in the environmental systems definitions in the Giessen Declaration is the food manufacturing, retail and distribution chain and its effects on the environment and the need to participate in a “shared priority … to protect the physical resources” of our world (Beauman et al., 2005, p. 783). The experts identified that students need to be aware of routines that should be maintained to provide a food-safe environment. As a result, food hygiene has been located within the environmental dimension of the populated food technology literacy model, where teachers may incorporate learning of food manufacturing and principles of food safety, particularly how food companies provide a consistently food-safe product.

**Menu planning and food purchasing decisions (MP)**

The food experts felt that students should be provided with opportunities to practise Menu planning and purchasing decisions about food (MP). This included being given the opportunity to purchase food according to a budget or for a personal need:

“How to spend your money on food and balance your accounts.”

“They need to know how to plan ahead and to do it within a budget.”
“Looking at prices as well, so that they’re not buying, looking at unit prices so they are buying the bigger size which may be costing them more per unit than if they bought two of the small size for the same amount.”

This indicates that a practical skill base underpins this component. As a result, the researcher has located this aspect as a contributing component to technological knowledge because a practical aspect is indicated.

_Sensory experience of food (SE)_

The food experts indicated that the Sensory experience of food (SE), particularly how foods should taste and an accurate identification of a particular food should be a knowledge that students are given the opportunity to develop. The experts commented that

“You’ve got a huge population who have no idea about the things they can eat and what it should taste like.”

“Developing a palate and actually tasting a wide variety of foods is an essential.”

As this is a practical, individual characteristic, the researcher placed this component within the aspect of technological knowledge because this is where the practical skill base in technology is located.

_Cookery skills (CS)_

The food experts identified that students should develop skill competence in food preparation by being given the opportunity to participate in cooking lessons. One commented:

“All cooking skills are absolutely essential, far more important than an ability to play the violin, do karate, or swim four stroke.”

The component Application of cookery skills (CS) has been placed in the centre of the populated food technology literacy model as an aspect of technological activity. Technological activity is the mode through which things happen in our world and from which technological artefacts are produced. Within the populated food technology literacy model, an aspect of technological activity could be described as the use of cookery skills in the production of a technological artefact.

_Use of literacy and numeracy skills (L&N)_

The food experts identified that students should be in possession of basic numeracy and literacy skills (L&N) so they were able to process a variety of information about food from a wide range of sources. One commented:
“I would expect them to be able to … read. We are assuming our clients are literate, but a trend I have started to notice is that illiteracy is an issue.”

And another listed a range of skills as being important:

“Being able to read. Or have some ability to follow a recipe. Yeah, being able to read, write and use maths, have some ability to read labels.”

The researcher placed this component within the aspect of technological knowledge as these skills are regarded as essential underpinnings to any understanding the students may develop. This also considered as being combined with the practical skill base of students and is used to make and use food artefacts. Being able to process, select and use information was regarded as a technological knowledge skill.

4.9 The populated food technology literacy model

The populated food technology literacy model in Figure 6 indicates where the expert originated components of technological food literacy have been located within the theoretical food technology literacy model. To make the diagram easier to read, abbreviations for the components are used. A key follows to indicate which component has been identified.
Key of Abbreviations for the Components of Food Literacy Shown on the Populated Food Technology Literacy Model

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Component</th>
</tr>
</thead>
<tbody>
<tr>
<td>FH</td>
<td>Food hygiene</td>
</tr>
<tr>
<td>FP</td>
<td>Food preparation from scratch</td>
</tr>
<tr>
<td>SE</td>
<td>Sensory experience of food</td>
</tr>
<tr>
<td>Sy</td>
<td>Systems that underpin food</td>
</tr>
<tr>
<td>MP</td>
<td>Menu planning and food purchasing decisions</td>
</tr>
<tr>
<td>CS</td>
<td>Application of cookery skills</td>
</tr>
<tr>
<td>L&amp;N</td>
<td>Use of literacy and numeracy skills</td>
</tr>
<tr>
<td>Cu</td>
<td>Cultural dimension and significance of food</td>
</tr>
<tr>
<td>CT</td>
<td>Critical thinking and decision-making about food</td>
</tr>
<tr>
<td>H</td>
<td>Health-giving properties of food</td>
</tr>
</tbody>
</table>

Figure 6. *The populated food technology literacy model*

As suggested by the analysis and comparison of the food experts’ ideas with the ideas expressed within the theoretical food technology literacy model, the components have been located within the model. For the three systems of food, these are indicated as abbreviations, as contained within the cylindrical shapes at the top of the diagram. As proposed, the components of Food hygiene (FH) and Systems that underpin food (Sy) are contained within each system of food suggested by the Giessen Declaration. The component Cultural dimension and significance of food (Cu) is included within the social systems dimension. The Health-giving properties of food (H) component is located within the biological systems dimension. These locations are suggested within the wording of the Giessen Declaration, in which the social systems allude to “food cultures” (Beauman et al., 2005, p. 785) and the biological systems are indicated to be concerned with “the interactions of food and nutrition” (Beauman et al., 2005, p. 783).
The concepts of technological knowledge are populated with ideas about food literacy comprising the components of Use of literacy and numeracy skills (L&N), Sensory experience of food (SE), Menu planning and food purchasing decisions (MP) and Food preparation from scratch (FP). These are shown underneath technological knowledge.

The component of Application of cookery skills (CS) is allocated to technological activity. This component considers the skills of and about cookery. Technological activity is how technological knowledge and volition combine to make an artefact. In the component Application of cookery skills (CS), food items are manipulated to produce a food product that meets people’s needs.

Finally, the ideas of technological volition are framed by the Critical thinking and decision-making about food (CT) component. This component encourages people to think widely and deeply about food and make decisions based on such thinking. Therefore, this component could inform people’s’ volition, or will and desire to produce a food artefact.

4.10 Summary

This chapter has answered the first research question, “What are the attributes of a food literate person?” (see Table 6), by reporting on the views of food experts reflecting upon their opinion of personal characteristics of a food literate person. These opinions were reaffirmed and clarified by the use of a Delphi methodology, which then asked the food experts to establish the answer to “What components are deemed essential for a technological food literacy education programme?” (see Table 6).

It was important to discover whether the views of the food experts matched with the ideas of the theoretical frame that underpins this research as this takes the theoretical ideas forward towards a conceptual frame that can be populated with views of food experts and may be useful in articulating the ideas about food literacy and the components that contribute to such an idea.

A comparison was conducted of the ideas of the experts and the framework suggested by the literature. Section 4.8 shows the population of the theoretical food technology literacy model with the essential components of food literacy views from the food experts. It was proposed that the ideas of the experts could be allocated within the structure of the model. Section 4.8 presents the analytic tool (see Figure 5), which was developed to investigate the wording of the components to see whether there was synergy between the experts’ opinions and the theoretical model. Continuing the analysis, Section 4.9 presented a comparison of the components of technological food literacy wording and the literature informing the theoretical food technology
literacy model. Some of the components fitted within several dimensions and are shown in the model. It was found that the structure of the theoretical food technology literacy model was flexible to accommodate this variability.

As a result of the comparison, the populated food technology literacy model was presented. All the components suggested by the experts were able to be located within the new model. Some components appear three times. This suggests that the populated food technology literacy model has the potential to be used when grouping the ideas of food experts. It would be useful to see whether this model could be used to group the ideas of teachers when they consider the components, and a report and analysis of these findings is presented in the next chapter.
Chapter 5: Findings: Teachers’ Views of the Populated Food Technology Literacy Model for Education

5.1 Introduction

This research regarded it as important to consider teachers’ views about what aspects of technological food literacy could be developed and taught in the classroom. In this chapter, the research question related to focus group discussions “How can the essential elements of a technological food literacy programme be combined as a teaching model?” will be explored and explained. As a consequence, this research question investigates “What are teachers’ interpretation of the components of technological food literacy?” In this chapter, how teachers interpret the components will be identified. This aspect of the research related to how focus groups of teachers interpreted the views of the experts and it will be explored and explained in Section 5.2. This section concludes with Section 5.2.4 critiquing the components. Section 5.3 reintroduces the populated food technology literacy model and investigates whether the teachers’ views of how these could be enacted in the classroom can be added to develop a food technology literacy education model. The findings of this chapter are summarised in Section 5.4.

5.2 Exploring and explaining the components

In Chapter 4, a research question investigated the components that food experts deemed essential for a food literacy education programme. This resulted in the development of a list of components (see Table 6). The component list, developed from the food experts’ viewpoints, was presented to teachers for discussion in a focus group situation. The responses from teachers form the focus of this chapter. The full versions of the components are as shown in Table 8.
<table>
<thead>
<tr>
<th>Theme and Subtheme</th>
<th>Component of Food Literacy</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disposition – Authentic</td>
<td>Food preparation from scratch</td>
<td>The disposition or personal characteristics or mannerisms that a 21st century food literate person may display include an ability to be innovative and try things, for example, try a new food, work without a recipe, be authentic, e.g., prepare food for a real family.</td>
</tr>
<tr>
<td>Knowledge – Culture</td>
<td>Knowledge of the cultural dimension and significance of food</td>
<td>The knowledge or literacy skills that a 21st century food literate person may display includes the knowledge of culture – knowing the role that food plays in the rituals and practices of particular groups in a society, an ability to recognise that food has an importance to oneself, and that food has a cultural dimension and significance.</td>
</tr>
<tr>
<td>Knowledge – Food Systems</td>
<td>Knowledge of the systems that underpin food</td>
<td>The knowledge or literacy skills that a 21st century food literate person may display includes the knowledge of food systems – the systems that underpin our food such as growing, distribution, retail, additives, processing, food labels.</td>
</tr>
<tr>
<td>Knowledge – Nutrition</td>
<td>Knowledge of health-giving properties of food</td>
<td>The knowledge or literacy skills that a 21st century food literate person may display include the knowledge of nutrition – the study of the health-giving properties of our food.</td>
</tr>
<tr>
<td>Skills – Critical thinking</td>
<td>Critical thinking and decision-making about food</td>
<td>The practice and application of skills with food that a 21st century food literate person may display include critical thinking – being able to think wider and deeper about food and act on that knowledge.</td>
</tr>
<tr>
<td>Skills – Hygiene</td>
<td>Food hygiene</td>
<td>The practice and application of skills with food that a 21st century food literate person may display include food hygiene – the application of food hygiene rules and guidelines.</td>
</tr>
<tr>
<td>Skills – Shopping</td>
<td>Menu planning and food purchasing decisions</td>
<td>The practice and application of skills with food that a 21st century food literate person may display include shopping skills – the practice and application of shopping skills to the purchasing decisions about food.</td>
</tr>
<tr>
<td>Skills – Tasting</td>
<td>Sensory experience of food</td>
<td>The practice and application of skills with food that a 21st century food literate person may display include tasting – experiencing food in a sensory way, knowing how foods should taste.</td>
</tr>
<tr>
<td>Skills – Cooking</td>
<td>Application of cookery skills</td>
<td>The practice and application of skills with food that a 21st century food literate person may display include cooking – the application of cookery skills to food.</td>
</tr>
<tr>
<td>Skills – Learning</td>
<td>Use of literacy and numeracy skills</td>
<td>The practice and application of skills with food that a 21st century food literate person may display include learning – in possession of basic numeracy and literacy skills.</td>
</tr>
</tbody>
</table>

The questions that focused the respondents’ responses were:

- When you look at the list, what springs to mind?
- Choose a specific component of technological food literacy and explain how you could teach it in the classroom.
Often, teachers’ perceptions on how they would interpret and justify action is voiced as an expression of their pedagogy or what they would “do” in the classroom. As a result, the focus group answers often reflected examples of teaching activities that might be conducted when a component was a context. The analysis of their suggested interpretations and enactment of these components and how they justified their position with an illustration of their teaching follows. This was developed by the researcher from an analysis of the audio-taped focus group conversations. Pseudonyms are used.

Each component will now be explored in turn using an extended version of the analytic tool (see Figure 5), through which essence statement descriptors from the literature were mapped to the components of technological food literacy identified by the food experts. An example of the analytic tool extended for focus group analysis is shown in Figure 7. Within this extended framework, the informing literature search words that populate the theoretical food technology literacy model are indicated by the typed phrases on the left column of the analysis framework. This left column will contain an essence statement developed from the literature, which is pertinent to the component being discussed. The component name is identified in bold typeface in this column, and the detail suggested by the food experts that informs that component is located in the central column of this extended analysis framework. Progressing down the right-hand side of the extended analysis framework are the teachers’ interpretations of ideas about how they could teach these components. This column is divided into suggested teacher and student activities. An example of the analysis, which uses aspects of the social system and Food hygiene (FH) components is presented in Figure 7.

<table>
<thead>
<tr>
<th>Essence statement descriptors for sections of the Food Technology Literacy Model</th>
<th>Components of Technological Food Literacy – from experts</th>
<th>Teachers interpretation “In the classroom...”</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Social System</strong>&lt;br&gt;The interaction of food and food cultures with issues which affects the sustenance…</td>
<td><strong>Food Hygiene:</strong>&lt;br&gt;Know and apply food hygiene rules…</td>
<td><strong>Teacher activity</strong>&lt;br&gt;“Formal teaching” – food hygiene behaviour training&lt;br&gt;<strong>Student activity</strong>&lt;br&gt;Doing personal hygiene routines</td>
</tr>
</tbody>
</table>

![Figure 7. The analytic tool – extended for focus group analysis – generic example](image-url)
The order in which the components will be reviewed follow the analytical frame used in Table 7, that is, firstly, the social dimension; secondly, the biological dimension; and thirdly, the technological activity section. Please note that the environmental dimension was discussed in a limited way by these teachers. As a result, ideas about teaching aspects of the environmental dimension are located in Table 9 and Table 11 where appropriate.

5.2.1 Social system

This section reviews the social system within the populated food technology literacy model, within which the components of Food hygiene (FH), Cultural dimension and significance of food (Cu) and Systems that underpin food (Sy) are situated. These components will be reviewed in turn.

5.2.1.1 Food hygiene

Table 9. Focus group analysis – social system – Food hygiene

<table>
<thead>
<tr>
<th>Essence Statement Descriptors for Sections of the Food Technology Literacy Model</th>
<th>Component of Technological Food Literacy – Key Phrases from Experts</th>
<th>Teachers’ Interpretation “In the classroom … might be …”</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Social System</strong>&lt;br&gt;The interaction of food and food cultures with issues that affect the sustenance and happiness of humans.</td>
<td><strong>Food Hygiene:</strong> Know and apply food hygiene rules&lt;br&gt;Guidelines to keep food safe&lt;br&gt;Critical area – affects all health&lt;br&gt;Underpins all of us</td>
<td><strong>Teacher activity</strong>&lt;br&gt;“Formal teaching” – food hygiene behaviour training supported by overhead projector information, role plays, do now activities and worksheets&lt;br&gt;Individual monitoring of students&lt;br&gt;The underlying microbiology principles taught&lt;br&gt;<strong>Student activity</strong>&lt;br&gt;Personal hygiene routines&lt;br&gt;Awareness and application of cross-contamination rules&lt;br&gt;Household cleaning routines&lt;br&gt;Basic first aid</td>
</tr>
<tr>
<td><strong>Biological System</strong>&lt;br&gt;The personal and population health nutritional status that influences and affects the personal health, nutrition adequacy and well-being of people.</td>
<td><strong>Food Hygiene:</strong> Cross-contamination</td>
<td></td>
</tr>
<tr>
<td><strong>Environmental System</strong>&lt;br&gt;The cultivation, conservation and depletion of living and physical resources resulting from environmental and ecosystem change. The food manufacturing, retail and distribution system.</td>
<td><strong>Food supply contamination</strong></td>
<td></td>
</tr>
</tbody>
</table>

Food hygiene had relevance for the teachers and was a common component in focus group discussions, and the teaching of food hygiene was described in some detail. Often the enactment was perceived to be a teacher-centred activity in which a component of food hygiene was
underpinned by a belief that the foundational principles were closely interconnected and needed to be explicitly taught to students. As a result, the teaching relied on the tacit knowledge of the teacher to convey the important aspects. Jackie described this as

“My formal teaching. It underpins absolutely everything.”

Jackie (interview line 995)

Pollyanna described teaching food hygiene as an inherent part of her teaching, which was linked in to the practical activities that were being undertaken at the time. She commented:

“I’m linking, it’s just a part of teaching …”

Pollyanna (interview line 912)

Annabel described an approach to food hygiene as being more

“using a thematic approach to your lunch pack but within that you’re touching on bits that you can see of food hygiene … you’d teach food hygiene but also teach application of cookery skill within that food hygiene unit.”

Annabel (interview line 1025–1030)

Fran explained that she used food hygiene as a starting point for her lessons but it later became embedded in the practical lessons the classes completed. She commented:

“The Year 9 food hygiene, we start with a video, and there’s a box in their workbook to write down the new words … but this becomes something that’s embedded in the practical work that they do, the hands on.”

Fran (interview line 498–501)

Victoria voiced a detailed discussion of what personal hygiene behaviours were expected of the students. She discussed the underpinning food hygiene information that was taught to her Year 9 and 10 classes when the students designed a healthy pie. Her teaching ideas were supported by a variety of teaching techniques and were scaffolded through the use of a student workbook, which she had brought with her to the meeting. Victoria initially started her lessons with a “do now” activity, setting routines in place through activities that the students did in class. She commented about how the teaching techniques changed as the lessons progressed:

“In the beginning it’s a whole lot of do nows or we do role plays and taking notes down.”

Victoria (interview line 1206)

As time progressed, Victoria began individually monitoring her students, observing and questioning their practices such as hand-washing, covering cuts and how they wrapped rubbish for disposal. Victoria felt that she drew on the knowledge the students brought to class rather than explicitly teaching the content. She commented:

“This draws on student knowledge rather than teaching. I mean, you do teach it but we are trying to get the kids to come up with the idea, like refreshing their memory.”
To assist her teaching, Victoria relied on information technology (IT) resources to keep the reminders to the front of the students’ attention while they were actually doing the food preparation work.

“You’ve always got a visual prompt ...”
Victoria (interview line 1237)

In this way, the thread of food hygiene set the scene and contributed to the practical lessons that were the main focus of the lesson at that point. Victoria discussed her teaching style for this aspect of her course. She felt that her lessons were underpinned by

“A lot of repetition ... getting them into a routine, making them aware of stuff ... making those connections between what you are saying and what you want them to do.”
Victoria (interview line 1243–1246)

The reason that Victoria perceived that food hygiene was best taught in this manner was related to developing the student knowledge of food hygiene skills. She commented:

“It’s developing them ... you’ve really got to emphasise in this classroom this is what we do ...”
Victoria (interview line 1254–1255)

The teachers perceived the component Food hygiene (FH) as holding some aspect of the social system in that they felt that teaching the students the reasons for enacting the food hygiene skills was important not only for themselves but for others for whom they might prepare food. However, their overarching perception of this component concerned the links that it held with the biological system and the role of bacteria, and the links this held with the interactions of personal health and illness. If the analysing chart is reviewed (see Table 9), it becomes evident that the teachers have interpreted this component as related to the biological system where food poisoning can cause illness and human distress. Their justification for teaching this component in this way was based on a biological concept of keeping food safe. Dorothy provided a clear example of this. She felt that students needed to learn the underpinning ideas of microbiology when considering food hygiene. Dorothy commented on the wording of the component:

“I think that in order to apply those rules they need to have a background and understanding of microbiology.”
Dorothy (interview line 86)

When asked to clarify her perception of this, Dorothy explained that the students needed to be provided with more in-depth knowledge in the component food hygiene and suggested that the model needed to indicate
“knowledge of how things multiply really easily, the conditions required for growth – the model needs more detail ... what is it that they are going to do in food hygiene?”

Dorothy (interview line 93–109)

No focus group members mentioned or discussed the role of food hygiene from an environmental stance, for example, ensuring that the food supply chain was food safe. Their focus was particularly on the personal level of food-safe behaviours that should be considered.

5.2.1.2 Cultural dimension and significance of food

Table 10. Focus group analysis – social system – Cultural dimension and significance of food

<table>
<thead>
<tr>
<th>Essence Statement Descriptors for Sections of the Food Technology Literacy Model</th>
<th>Component of Technological Food Literacy – Key Phrases from Experts</th>
<th>Teachers’ Interpretation “In the classroom … might be …”</th>
</tr>
</thead>
</table>
| **Social System**  
The interaction of food and food cultures with issues that affect the sustenance and happiness of humans. | Cultural dimension and significance of food:  
Roles and rituals with food  
A way cultural groups communicate  
Sense of purpose to food  
There’s more to food than just eating it | Teacher activity  
Influences of food on life styles and social interactions  
Historical aspects of food  
Ethnic foods and cultural diversity  
Feeding ourselves and our families |
| **Student activity**  
Sharing food  
Historical aspects of food  
Investigate their ethnicity and related food habits | |

There was a difference in opinion between the food experts and the respondent teachers in the focus group discussion over the wording of this component. Respondents felt that this component title should read “Knowledge of the cultural dimension and social significance of food” to reinforce the wider role food plays within societal interactions.

All the focus groups perceived that the term “cultural” would be narrowly interpreted by foods teachers. Helen commented:

“I think that if you put this out there now, different teachers would look at that with a completely different slant.”

Helen (interview line 1095)

There was concern that “cultural” would be perceived as studying the food habits and patterns of a particular cultural group. For example, the following question was posed to the interviewer during a focus group discussion:

“Does this mean like hāngi practice and all those things historical in New Zealand?”
It became apparent through the focus group discussions that the word “culture” was perceived differently by teachers. Helen commented:

“When I think of the cultural dimension of food I sort of think culture and its more explicit viewpoint as in what has happened in New Zealand and it’s changed from British/European to a melting pot. Is that the culture you’re talking about?”

Helen (interview line 1260).

And Dorothy responded:

“it’s sort of looking at the history of where different foods have come from, hāngī, umu, and so on.”

Dorothy (interview line 1269)

There was discussion about this component in some detail and the participants contributed additional statements to clarify the content that may guide teacher practice. The social system viewpoint from the literature discussed the loss of food cultures, amenities and skill. The intention of this component as defined by the food experts provided opportunities for study that varied from the historical context of food through to an exploration of current lifestyle trends in foods, for example, the availability of takeaway and convenience foods in modern life. Focus group participants also interpreted that food education should provide opportunities to reflect on the importance of food from other perspectives, and not just that of nourishment. But the teachers held a narrow perception of the term “culture”. They perceived the cultural aspect as an integrated aspect of teaching food and that some food practices of the past needed to be considered in lessons as students did not have a historical perspective about food. Fran summarised their perspective:

“the culture dimension as being what now can be linked back to what it was before. In the nature of society you could do interviews and you find out about the ways things were done back then and a lot of context that students are unaware of.”

Fran (interview line 159–162)

This historical aspect was an interesting perspective. The teachers’ identification of a pedagogy was to investigate food cultures from a historical stance as an avenue to explore these changes to people’s food culture.

5.2.1.3 Systems that underpin food

In the populated food technology literacy model, the component Systems that underpin food (Sy) is located in all three systems – social, biological and environmental. This identification is underpinned by the Giessen Declaration indicating that these are three systems that underpin the dimensions of nutrition science (Beauman et al., 2005). The Giessen Declaration describes a
food system as one that is “shaped by biological, social and environmental relationships and interactions” (Beauman et al., 2005, p. 784) and particularly refers to “how food is grown, processed, distributed, sold, prepared, cooked and consumed … and its effect on well-being and health, society and the environment” (Beauman et al., 2005, p. 784). All three systems are discussed in this section for ease of reading.

Table 11. Focus group analysis – social, biological and environmental systems – Systems that underpin food

<table>
<thead>
<tr>
<th>Essence Statement Descriptors for Sections of the Food Technology Literacy Model</th>
<th>Component of Technological Food Literacy – Key Phrases from Experts</th>
<th>Teachers’ Interpretation “In the classroom … might be …”</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Social System</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The interaction of food and food cultures with issues that affect the sustenance and happiness of humans.</td>
<td>Systems that underpin food: Marketing Food packaging Food labels Know what is in your food before you eat it Preservation of food</td>
<td>Teacher activity Investigate systems that underpin the food in any aspect How food is grown Investigate new foods in markets Comparison of products Food processing Sustainability and waste Globalisation Retail and food distribution Fair trade and ethics</td>
</tr>
<tr>
<td><strong>Biological System</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The personal and population health nutritional status that influences and affects the personal health, nutrition adequacy and well-being of people.</td>
<td>Systems that underpin food: Additives Food processing</td>
<td>Student activity Reading food labels Ingredient comparisons</td>
</tr>
<tr>
<td><strong>Environmental System</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The cultivation, conservation and depletion of living and physical resources resulting from environmental and ecosystem change. The food manufacturing, retail and distribution system.</td>
<td>Systems that underpin food: Growing Distribution Retail Production</td>
<td></td>
</tr>
</tbody>
</table>

The focus group respondents perceived that a wide scope of systems was covered in this component definition. It was felt that this component provided opportunities to study food as a context rather than as an item or an ingredient for use. Preti commented:

“I like the idea of the knowledge of system underpinning food, it seems quite explicit here.”

Preti (interview line 382)
Lynn’s focus group discussed how the idea of systems meant that the topics covered could be quite fluid in context. For example, the food-labelling system example provided in the Systems that underpin food (Sy) component could also be considered under the knowledge of the Health-giving properties of food (H) component. Lynn commented:

“food labels, that’s right it’s knowledge of systems. But reading it for nutrition purposes? That’s not [considered] here.”

Lynn (interview line 628)

The focus groups felt that global perspectives of systems needed to be included. This is a point of difference between the Giessen Declaration and the views of experts. One group held a conversation about the global systems that underpin our food supply and were concerned that the examples seemed more focused at the country level than the global. They commented that the systems of growing and distribution should also include an environmental and sustainability focus:

“I think this is also environmental. What about sustainability. I can see this is where should go. But it’s also like your wastage and that sort of thing.”

Molly, Jackie and Pippin (interview lines 767–771)

Another group felt that the component suggested there were opportunities to discuss any systems that underpin the food environment and these opportunities needed to include the wider context, for example, globalisation, sustainability, waste management and world fair trade, as well as closer-to-home discussions on food production, development, distribution, processing and the retailing requirements and environment. Helen commented:

“I think you’ve got knowledge of the systems that underpin food and I know through your definition you’re looking at, you’re harvesting, you’re processing but could it also go in there, knowledge of the systems that underpin food in any aspect whether it be from harvesting on a global scale to food preparation on a local home scale.”

Helen (interview line 308–312).

There were active conversations about the use of Systems that underpin food (Sy) as a teaching topic. An illustration of a system was often able to be positioned in several of the dimensions, with examples that demonstrated this. This concurs with the ideas from the Giessen Declaration that there is a complex underpinning of interactions in food systems and they are found in all dimensions of food.

5.2.2 Biological system

This section reviews the biological system of the populated food technology literacy model, within which the components of Health-giving properties of food (H) and Systems that underpin food (Sy) are nested. This section discusses the Health-giving properties of food (H) component
only, as the Systems that underpin food (Sy) section has been included in the social section (see Table 11).

5.2.2.1 Health

Table 12. Focus group analysis – biological dimension – Health-giving properties of food

<table>
<thead>
<tr>
<th>Essence Statement Descriptors for Sections of the Food Technology Literacy Model</th>
<th>Component of Technological Food Literacy – Key Phrases from Experts</th>
<th>Teachers’ Interpretation “In the classroom … might be …”</th>
</tr>
</thead>
</table>
| **Biological System**  
The personal and population health nutritional status that influences and affects the personal health, nutrition adequacy and well-being of people. | Health-giving properties of food:  
**What gives health in food and what doesn’t**  
Healthy eating patterns  
Healthy lifestyles  
Health problems  
Managing our food intake | Teacher activity  
Hauora  
Influences on food choices  
Classification of foods |
|  |  | Student activity  
Recipe adaptations  
Active application of knowledge  
Four food groups  
Health properties of food  
Food choices |

All focus groups felt that the knowledge of Health-giving properties of food (H) component was an underpinning component of a foods teacher’s practice. As a result, there was a strong perception that the component Health-giving properties of food (H) had a role to play in developing the technological food literacy of students. All of the suggested teacher and student activities were in alignment with the views of the food experts. An emphasis of the teachers’ practice was a belief that they were equipping the students with knowledge for their future.

Annabel described her teaching as being

“*about teaching kids making good food choices and just being aware of what they’re actually doing … people have nutrition diseases and they are preventable …*”

Annabel (interview line 15)

Dorothy was hopeful that in teaching her students about the Health-giving properties of food (H) she was also providing them with opportunities to translate this into their practical work:

“*I would hope that the students we educate that ‘knowledge of health-giving properties of food’, then they’ll then use it in their food technology practice. *”

Dorothy (interview line 1363)

All four focus groups had teachers who felt they would include teaching ideas about what determines people’s health. The respondents all had different methods of approaching this topic. Pippin and Jackie focused developing in their students
“a much broader knowledge of food and what it does or doesn’t do for them and making good choices about food.”

Pippin (interview line 1152)

Jackie’s approach was also focused on a broad knowledge of foods and the classification of those foods in a nutritional model:

“I would teach the four food groups because that’s part of nutrition. That’s a really big part of nutrition, I don’t teach the individual foods, I teach the groups.”

Jackie (interview line 667)

Dorothy and Annabel’s approach was more practically oriented:

“we actually get them to do adaptation of recipes ... choosing the more health aspects of the changes.”

Annabel (interview line 163)

Dorothy hoped that she educated

“Hauora ... that knowledge of health-giving properties of food then they’ll then use it in their food technology practice.”

Dorothy (interview line 1363)

The focus groups brainstormed the key teaching messages that might be covered under this component. It was interesting to note that they focused on an encompassing “health” perspective of teaching to this component, rather than selecting specifics such as teaching about nutrients and nutrition. This may be due in part to the role of the health curriculum area which most focus group participants had knowledge of and experience in teaching.

5.2.3 Technological activity

This section reviews technological activity in three sections: technological activity, technological knowledge and technological volition.
There were quite detailed conversations about the meaning and intent behind the component Application of cookery skills (CS) in the focus groups. The discussion centred on the differences between the components Application of cookery skills (CS) and Food preparation from scratch (FP). If we look at the definition statements developed with the experts shown in Table 8, we can see that the intent from the experts was that the Application of cookery skills (CS) component refers to a practical skill, whereas the Food preparation from scratch (FP) refers to a personal disposition or mannerism that a food literate person would adopt.

While the respondents could see the difference in meaning, there was concern that other teaching professionals would view these components as one and the same. Consequently, they could skim-read over the detail, which could lead to diluting the strength of this component.

Annabel and Helen discussed this component in some depth. Annabel’s perspective was that the Application of cookery skills was about

“all the processing and understanding why you’re doing things.”

Annabel (interview line 1130)

And Helen described it as

“the whole scientific basis as opposed to, here, cream the butter and sugar.”

Helen (interview line 1133)

They concluded their discussion by suggesting that Application of cookery skills was about
“emphasising technique all the time and why you are doing it ... the call for assistance – the whole thing is going okay because we’re doing this, because of this, and then you do this, and this.”

Annabel and Helen (interview lines 1148–1152)

The concern was that these two areas overlapped with each other and that foods teachers needed to adapt their teaching practice to acknowledge that within their classroom practice there is a skill and practice aspect to preparing foods, for example, handling knives, measuring correctly, and identifying and using the correct tool for the task in hand. Pollyanna commented that some of the examples overlapped; however, she identified the difference between the two as being

“probably part of application AND food preparation from scratch ... if you think, food preparation from scratch, anybody can prepare a meal, but is it going to be healthy, have they made it without killing themselves, another person, so it’s the knowledge that is there.”

Pollyanna (interview line 1286)

The respondents felt that there are specific functional knowledges that the Application of cookery skills component relates to and these included the management of areas such as the kitchen environment, resources and time. They suggested that these knowledges should map to the food preparation being undertaken. Jackie commented that this approach could be done by utilising teachable moments that arose during practical sessions:

“it’s what comes up in the practical, you would need to teach what matters ... but it’s something absolutely relevant and it becomes a teaching point in itself.”

Jackie (interview line 953–955)

Molly, Jackie and Pippin clearly identified the differences:

“some of those are actually written as characteristics, not necessarily a skill, so, for example, the food preparation from scratch is able to be innovative so that’s a personal characteristic but you would teach it from the skill perspective in cookery skills to build that personal characteristic.”

Molly, Jackie and Pippin (interview lines 1030–1035)

The teachers could, after discussion, discern and then identify the difference in meaning between the components Application of cookery skills (CS) and Food preparation from scratch (FP). This would be an important difference to identify and clarify for teachers if the food technology literacy model was used to inform teacher and classroom practice.
5.2.3.2 Technological knowledge – Use of literacy and numeracy skills

Table 14. Focus group analysis – technological knowledge – Use of literacy and numeracy skills

<table>
<thead>
<tr>
<th>Essence Statement Descriptors for Sections of the Food Technology Literacy Model</th>
<th>Component of Technological Food Literacy – Key Phrases from Experts</th>
<th>Teachers’ Interpretation “In the classroom …”</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Technological Knowledge</strong> Practical ideas, the making and using of food artefacts and ...</td>
<td>Use of literacy and numeracy skills: Having basic literacy and numeracy skills Read food labels Interpret recipes Understand how to apply skills to food</td>
<td>Teacher activity Targeted teaching of literacy and numeracy within foods lessons</td>
</tr>
<tr>
<td></td>
<td><strong>Student activity</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cookery terms</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sensory evaluation terms</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Recipe reading</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Research skills</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Read and critique documents</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cost recipes</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Accurate measuring</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Fractions</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Budgeting</td>
<td></td>
</tr>
</tbody>
</table>

The teachers were able to interpret the component Use of literacy and numeracy skills (L&N), and they described in detail a variety of different ways in which they would enact this in their teaching as well as provided a list of key tasks they felt students should be able to undertake. Respondents felt that literacy was a very important aspect of foods teaching because

“the kids need to actually be able to talk about what’s happening”
Jackie (interview line 906)

The respondents felt it was important that the aspects of literacy and numeracy that were taught should come from their food education environment and were not imposed from any wider literacy or numeracy needs that the students might already possess. Molly, who had trained as an ESOL (English for speakers of other languages) teacher in addition to being a foods teacher, commented:

“It’s [literacy and language] safe to come out of the lesson. I don’t think it’s something that you should impose on the programme.”
Molly (interview line 966)

Helen commented that she needed to teach her students in a manner that

“Extend[s] their repertoire of words, so they are thinking about it more.”
Helen (interview line 918)

There was the observation by Jackie that students needed to grasp new terms, for example, food-specific terms:
“in the practical, there’s lard, but then it’s a lardon, what’s the meaning of that?”

Jackie (interview line 956)

Jackie also included research skills in her identification of literacy skills when she identified the use of IT and internet research about recipes and ingredients. She commented:

“Research is coming under literacy … it’s a skill in itself, jump on the computer … oh look. I think that is a skill under literacy … that ability to research and resource material."

“Add in there on how to resource it, but also how to filter and analyse it.”

Jackie and Pippin (interview line 418–421)

The focus groups explained that numeracy skills specific to these year levels in food education included how to cost recipes, complete accurate measuring and work to a budget. Jackie commented:

“we could do something about the purchasing decisions for food.”

Jackie (interview line 144)

Pollyanna commented that they conducted targeting teaching about measurement with their students:

“Our students can do measuring because we’ve targeted that already and they know how to measure … this is a tablespoon not that.”

Pollyanna (interview line 935–940)

Lynn described students needing both literacy and numeracy skills when they needed to

“be able to read the recipe and measure accurately and figure out now I need three-quarters of a cup but I only have a half cup and a quarter cup measure.”

Lynn (interview line 160–162)

Annabel discussed a lunchbox unit she taught to her Year 9s in which they produced a lunch pack for sale. She commented:

“The numeracy skill … they’ve got a budget of $5 and so we make a whole range of stuff which will go in the lunch pack, price it out … narrow down what will sell for $5 so they are working the money side of it as well.”

Annabel (interview line 1002–1007)

The focus groups were able to articulate ways in which literacy and numeracy came from the lessons they taught. They suggested a range of literacy skills specific to food education that they felt would guide their students. These included understanding specialist cookery terms, sensory terminology and recipe reading, as well as developing an ability to source, critique and use research materials. This indicates that there are many examples of literacy and numeracy tasks that could be used in a food technology classroom.
5.2.3.3 Technological knowledge – sensory experience of food

Table 15. Focus group analysis – technological knowledge – Sensory experience of food

<table>
<thead>
<tr>
<th>Essence Statement Descriptors for Sections of the Food Technology Literacy Model</th>
<th>Component of Technological Food Literacy – Key Phrases from Experts</th>
<th>Teachers’ Interpretation “In the classroom … might be …”</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technological Knowledge Practical ideas, the making and using of food artefacts and …</td>
<td>Sensory experience of food: Know how food should taste Food is a nutrition and a sensory experience Develop tastes at a young age Know about ingredients and flavours</td>
<td>Teacher activity Sensory analysis techniques Class taste testing experiences Senses used in designing of products/specifications</td>
</tr>
<tr>
<td>Student activity Identifying …</td>
<td>Smell Colour Texture of products Colour and look of products Flavours Correct seasoning Use of correctly cooked indicators</td>
<td></td>
</tr>
</tbody>
</table>

There was a difference in opinion between the food experts and the focus group respondents about the wording of the component Sensory experience of food (SE). Members of the focus groups identified that the experts only identified taste as being a sensory indicator and they perceived that this needed extension to include other aspects of the senses that affect how we feel about food. The focus group respondents felt that in the classroom, smell, look, texture and taste should also be explored as part of a sensory awareness of foods.

Dorothy commented:

“I would like to see a bit more detail … sensory experience of food, it’s written here experiencing food in a sensory way, knowing how food should taste, and I’ve added look, smell and feel beside that as well.”

Dorothy (interview line 966)

“Yes, you can improve it, they evaluate how did it taste like, feel like, look. Taste, texture, look and smell.”

Lynn (interview line 1047)

Lynn commented that enabling students to sensorially evaluate their food product was an important step in allowing the students to justify their work and develop their food products. She commented:

“They need to start thinking about texture, and what is texture and why does it have to smell good. Not that it’s just taste, go yum that was good or yuk that was horrible.”

Lynn (interview line 1035–1039)
Fran talked about using the sense of taste as the last step in their sensory evaluation lessons:

“We had a cheesecake that was blue and they don’t know what it is. They don’t get to taste it until that’s the last thing, it’s clear they’ve got flavour ... they have to identify as well as being aware of the other senses, ... choose words relevant to the experience ... a food bank like appearance and aroma, like garlicky ... they have the words, and they have to link it to food they are familiar with ...”

Fran (interview line 460–478)

The focus groups commented about how, as a start point, limited the students’ repertoires of words were, and that this aspect of their education needed development:

“To start with, they need to be able to express themselves.”

Jackie (interview line 907)

“They need to get the language about what things taste like, instead of ‘yum’ or ‘you know’.”

Fran (interview line 453)

“You need to teach them what words go into what category. Extending their repertoire of words, so they are thinking about it more than just ‘yum’, ‘yuk’ and ‘it’s nice’.”

Helen (interview line 918–919)

The focus groups felt that students should be provided with experiences of and with food in the cookery process to develop their level of sensory awareness (e.g., correct seasonings, recognising al dente food items, correcting lumpy and undercooked sauce, use of colour charts to determine cooked levels as well as typical baking tests of baked product “bounce”).

Jackie talked about tasting the products as the students cooked to develop senses. She said

“Sensory experience. Sit down, taste it. How do you know its al dente? Is the sauce right, what can we do to correct the seasoning of it?”

Jackie (interview line 594–595)

Helen commented that they used paint colour charts to identify food profiles. She said

“we had a colour chart and put the colour chart against the three scones, this one is too pale, okay what colour was that, so, when you make your scone, that will be unacceptable ... based on the fact you said the scone was too pale.”

Helen (interview line 898–901)

Teachers concluded that the component statement for sensory experience of food needed to be extended to include a wider range of human senses. They also felt that extending the sensory word repertoire was a key requirement and this linked with the component use of literacy and numeracy skills.
5.2.3.4 Technological knowledge – Menu planning and food purchasing decisions

Table 16. Focus group analysis – technological knowledge – Menu planning and food purchasing decisions

<table>
<thead>
<tr>
<th>Essence Statement Descriptors for Sections of the Food Technology Literacy Model</th>
<th>Component of Technological Food Literacy – Key Phrases from Experts</th>
<th>Teachers’ Interpretation “In the classroom … might be …”</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Technological Knowledge</strong> Practical ideas, the making and using of food artefacts and ...</td>
<td><strong>Menu planning and food purchasing decisions:</strong> Shopping skills to purchase “good” food Budget skills learned Essential basic skill Used for health management How to spend money</td>
<td>Teacher activity Food purchasing – knowing how to select foods, value for money, seasonal shopping, convenience foods, allergy awareness, budgeting Influences on food choices <strong>Student activity</strong> Convenience foods Menu planning Shopping skills Family meal preparation</td>
</tr>
</tbody>
</table>

The component Menu planning and food purchasing decisions (MP) was identified as one that provided a background upon which an authentic activity could be based. Pippin reflected that any dishes to be planned and purchased could be based on a real family situation. She commented:

“**combining this is technology really, because you are dealing with an application of skills and knowledge and also a real family, it could be food for a real family as your client and you have to apply these certain skills through your knowledge of this. It’s about selecting ingredients and choosing how much you’re going to feed them.**”

Pippin (interview line 110-116)

Helen and Fran felt that this component was a way to link the other components together in a unit of work, in which the components fed into the idea of development of a meal

“**to have it all linked as a holistic piece of work with this component, and this component creates the final product.**”

Helen (interview line 939)

Fran also viewed this component as a way to integrate food in food technology lessons. She commented:

“**I think that this is a way to integrate the food lessons with technology, modifying product for family, packaging, something like that.**”

Fran (interview line 609)

Pippin, Molly and Jackie discussed this component and debated what the topic of budgeting could be linked to: whether it should have been explicitly identified in this component, Menu
planning and food purchasing decisions (MP), or whether it had a role in the component Use of literacy and numeracy skills (L&N), or in the component Health-giving properties of food (H):

“there’s decision making about food, budgeting could come into that. It’s got shopping skills but there’s nothing there that says about money. I think budgeting would be one thing specified … there’s nothing about a budget to be used on food. It’s kind of referred to, but not explicit, is it? Is it in numeracy?”

Pippin, Molly and Jackie (interview line 609)

Lynn also commented about budgeting, but she intimated that this was inherent in the component. Lynn’s approach was to link this component with the component Health-giving properties of food (H):

“I’m really happy to see things like food purchasing, as well as them understanding and being able to have the basic skills to plan a meal, to know how to budget, purchase how to buy food properly. … thinking about is this a community health perspective, and diabetes and other issues, to me this is a basic food literacy.”

Lynn (interview line 480–484)

The respondents viewed teaching this component from a technological perspective, through which the ideas of authentic practice and intervening in a situation to develop a solution could underpin the teaching ideas. This is an underpinning philosophical idea for technology education (Harwood, 2012). A variety of teaching suggestions were made, using this component as a linking component that could lead to the introduction of another topic or component of food literacy being discussed.

5.2.3.5 Technological knowledge – Food preparation from scratch

Table 17. Focus group analysis – technological knowledge – Food preparation from scratch

<table>
<thead>
<tr>
<th>Essence Statement Descriptors for Sections of the Food Technology Literacy Model</th>
<th>Component of Technological Food Literacy – Key Phrases from Experts</th>
<th>Teachers’ Interpretation “In the classroom … might be …”</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technological Knowledge Practical ideas, the making and using of food artefacts and …</td>
<td>Food preparation from scratch: Innovation Trying new things Authentic situations Learn about ingredient action by doing</td>
<td>Teacher activity Encourage innovation with recipes Cook Investigate seasonal foods Recipes that can be easily adapted</td>
</tr>
<tr>
<td>Student activity Preparing real food Prepare dishes to feed a family group Experiment with food</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The respondents did voice concern over the component worded as Food preparation from scratch (FP). Focus groups held quite a debate over the meaning of the term “from scratch”. They concluded that the term “from scratch” meant that the students would be working without a recipe. Helen summarised the view of the focus group by stating that they felt Year 9 and 10 students needed

“a baseline which is more structured than starting from scratch.”

Helen (interview line 260)

Another focus group did not interpret this term quite so literally. They suggested that this approach meant that they would be able to

“teach with a pattern. You are enabling kids to take a portion of passion, the knowledge of food, the ability to pick up a book, actually look at it, and go, yeah, I really like this, I can do it, I’ve heard of it, we’ve tried it, we’ve used it, we’ve tasted it.”

Jackie (interview line 90–94)

Lynn felt that this would mean that her students

“would be able to follow the recipe they’ve been given … decide what to put in when they change a recipe.”

Lynn (interview line 307)

Molly suggested that the component Food preparation from scratch (FP) would include basic meal preparation skills for a family meal where the students would develop the skills to be able to

“Prepare food for a real family.”

Molly (interview line 251)

Pippin was pleased an approach like this be considered for classroom foods teaching as she felt it meant she could

“teach what we are able to do and not have to apologise for it.”

Pippin (interview line 526)

Pippin described teaching this component from a student-centred direction. She discussed brainstorming with her students about what excited them about food. From this discussion, she suggested that you could come up with a structure of practical lessons, which the students had suggested, around which she would structure a unit of learning based on the Health-giving properties of food (H) component but practising Food preparation from scratch (FP). Pippin commented:

“We’d start, where the kids love to cook and love to eat. We’ve got the knowledge, we know what we want them to have.”

Pippin (interview line 683)
Clarity may need to be offered around the meaning of “from scratch”. The intent from the experts was that students would be provided with a range of baseline recipes and skills and a variety of recipe techniques and equipment so they would develop the confidence and be prepared to innovate with their food preparation. Based on this vision, the focus group teachers agreed with the experts. The teachers felt that a food technology classroom should promote an atmosphere of innovation, creativity, experimentation and adaptation in trialling foods that should underpin all practical activities. Lessons based around a theme such as family meals or breakfast products and the development of a product from a base recipe such as muffins, pies or baked potatoes were offered as examples of how food preparation from scratch could be taught.

5.2.3.6 Technological volition – Critical thinking and decision-making about food

Table 18. Focus group analysis – technological volition – Critical thinking and decision-making about food

<table>
<thead>
<tr>
<th>Essence Statement Descriptors for Sections of the Food Technology Literacy Model</th>
<th>Component of Technological Food Literacy – Key Phrases from Experts</th>
<th>Teachers’ Interpretation “In the classroom … might be …”</th>
</tr>
</thead>
</table>
| **Technological Volition**  
The will to do, based on a view of reality, ethics, moral compass, world view | **Critical thinking and decision-making about food:**  
Wide and deep thinking  
Making decisions  
Acting on decisions  
How to make “right choices” about food  
Innovation fostered and products | **Teacher activity**  
Integrating ideas  
Questioning about real ideas and issues  
Problem-solving  
Active questioning |
| **Student activity**  
Problem-solving around a product  
What decisions do they have to make as they work  
Critically question their work |

All focus groups supported the idea of the component Critical thinking and decision-making about food (CT). Molly talked about teaching her students critical thinking from a collaborative approach, where they would get together and discuss issues. Molly commented:

“[they] would talk it through and come up with what they would like to do and explore, so therefore you are getting the thinking skill, getting them working together, and it will all just go.”

Molly (interview line 848–849)

Molly felt that an approach to food education from this perspective was much fresher and

“it opens horizons”

Molly (interview line 876)
Fran and Preti had a conversation about how this component underpinned the thinking activities they could hold with their students within other components in the model. They decided that this component was about working with their students to develop

“critical decision making about food, being able to think wider and deeper about food and act on that knowledge.”

Fran and Preti (interview lines 110 and 111)

Helen felt that critical thinking was integrated as they worked with students. She commented:

“A lot of what we do isn’t particularly separate … you’re actually integrating it all the time, doing a comparison, talking about their choices …”

Helen (interview line 404)

Pippin agreed. She stated that this component was just something

“that we do when you learn, it’s part of the process … you don’t have to pull it out and say, look I’m going to teach this.”

Pippin (interview line 404)

In conclusion, Fran commented that in Year 9 and 10 foods lessons, the critical thinking undertaken would be

“dependent on what kind of topic you have.”

Fran (interview line 723)

The teachers felt that critical thinking and decision-making about food was an important underpinning construct of food education. They felt that making this aspect explicit in technological food literacy education would provide opportunities for students to develop broader and deeper thinking about food issues. Students developing a “broad notion of technological literacy” is seen as a way forward for 21st century learners (A. Jones et al., 2013). The focus groups felt that critical thinking and decision-making in the classroom integrated practical and theoretical tasks and provided opportunities for students to reflect on real issues and topical current events, and make decisions about food. The need for authenticity and the use of authentic contexts in the teaching and learning of technology has been a strong message as technology education has evolved (McCormick, 1994; Stein, McRobbie, & Ginns, 2001). It was apparent that this message had informed the focus group teachers’ pedagogy. Suggestions of key messages that could be covered included food security, the global distribution of food, food miles, reducing fat/sugar/salt contents in recipes and the ethical issues behind food decisions as topics for critical thinking activities.
5.2.4 Critiquing the components of the model

In developing a model to describe each component and linking this to teaching practice, it was important to gather the teachers’ input and feedback regarding their perception and interpretation of the component and their justification for such perspectives. The experts may have suggested an approach, but the model needed a visualisation of how it could be utilised by current practitioners in the classroom to assist with its practicality, pertinence and realism. Suggestions from this study showed that the approach of the model and the information was new:

“I’ve not seen a model like this before.”
Fran (interview line 370)

These focus group findings seem to indicate that teachers felt encouraged and reassured by the indications from the expert panel of what should be taught and what they felt they were teaching:

“This model does give us an outline of what industry sees as a food literate person and it would provide consistency, and reassures that we are doing the best for students.”
Pollyanna (interview line 443)

“Knowing that they’ve come up with this which is what we teach is quite reassuring.”
Helen (interview line 428)

When the teachers specifically reflected on the component being applied within the food technology learning area of The New Zealand Curriculum (Ministry of Education, 2007), they concluded that the components provided capacity to accommodate teachers’ pedagogy and provided a way to gain a deeper understanding of technological food literacy. They also suggested that four components needed to be reworked:

- The component Cultural dimension and significance of food (Cu) title needed to be altered to the “Cultural dimension and social significance of food”.
- The component Sensory experience of food (SE) descriptor needed to be altered to include the experiences of other senses besides taste.
- It was felt that more information needed to be provided on the component Food preparation from scratch (FP) descriptor – specifically, the meaning and intent behind the term “from scratch” – and that clarification was needed on the difference in intent between the component Food preparation from scratch (FP) and the component Application of cookery skills (CS).
• The component Systems that underpin food (Sy) descriptor needed to consider the effects of globalisation on systems. This is a point of difference from the Giessen Declaration and the views of experts.

The focus group participants also perceived that the components Critical thinking and decision-making about food (CT) and Use of literacy and numeracy skills (L&N) could be taught within the context of food education. This view is supported by Williams (2009), citing the research findings of Stables, Rogers, Kelly and Folias (2001) whom specified that technology was seen as an avenue through which literacy and numeracy could be taught. The concern of this approach is that technology education needs to be “driving the bus”, with literacy and numeracy as the passengers, rather than the other way around. The focus group participants suggested ways in which food education could “drive” the teaching and learning, using learning tasks that focused on the students’ developing literacy and numeracy skills in context.

5.3 Combining the populated food technology literacy model and the teachers’ perceptions of the components

The theoretical food technology literacy model (see Figure 1) developed from the literature review has been populated with the views of food experts on what they perceived to be the components of technological food literacy. This populated model is shown in Figure 7 as the populated food technology literacy model.

The analytic tool (see Figure 5) that was used in identifying significant phrases in the theoretical food technology literacy model and the components of technological food literacy has been extended and discussed in this chapter (see Figure 7). The perceived teaching content and suggested student activity have been added to the analytical frame.

The purpose of this section was to determine whether the populated food technology literacy model (see Figure 6) could be extended again to include these views.

To show how the sections link, it was necessary to reduce the diagram, as shown in Figure 6. A small populated food technology literacy model forms the centrepiece of the overall diagram. The colours used in earlier versions of the model have been used to help link to the new sections of the model, which are in exploded format for ease of reading.

The essence statement as suggested from the literature (see Table 1) heads each system. The essence statement serves to describe each system of the food technology literacy education model (see Figure 8).
The components of technological food literacy are indicated in the left-hand column that descends from each system. The components were identified from the experts’ views and were introduced in Table 6 as the final list of suggested components of technological food literacy. The placement of the components is as suggested from the populated food technology literacy model. For ease of reading, the components are presented as abbreviations.

The food technology literacy education model has been populated from the teacher and student activities suggested by the focus group participants that have been presented in this chapter. These are presented as the central and right-hand columns that inform each system.

The food technology literacy education model (see Figure 8) is a model of a potential food technology literacy, with suggestions for teacher and student activities.

**Key of abbreviations within the food technology literacy education model (see Figure 8).**

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>FH</td>
<td>Food hygiene</td>
</tr>
<tr>
<td>FP</td>
<td>Food preparation from scratch</td>
</tr>
<tr>
<td>SE</td>
<td>Sensory experience of food</td>
</tr>
<tr>
<td>Sy</td>
<td>Systems that underpin food</td>
</tr>
<tr>
<td>MP</td>
<td>Menu planning and food planning decisions</td>
</tr>
<tr>
<td>CS</td>
<td>Application of cookery skills</td>
</tr>
<tr>
<td>L&amp;N</td>
<td>Use of literacy and numeracy skills</td>
</tr>
<tr>
<td>Cu</td>
<td>Cultural dimension and significance of food</td>
</tr>
<tr>
<td>CT</td>
<td>Critical thinking and decision-making about food</td>
</tr>
<tr>
<td>H</td>
<td>Health-giving properties of food</td>
</tr>
</tbody>
</table>
Figure 8. The food technology literacy education model
5.4 Summary

This chapter has answered the research question “What are teachers’ interpretations of the components of technological food literacy?"

The responses demonstrated that the teachers were able to express ways in which the component concepts could be linked to The New Zealand Curriculum (Ministry of Education, 2007). Teachers visualised and then discussed between themselves in the focus groups the potential student and teacher activities within each technological food literacy component. This approach recognised the teachers’ deep level of awareness of the underpinning constructs of food education. Discussion within the groups was often animated when the participants discussed and contributed similar ideas to a suggested way to teach a component or combine them in a teaching unit.

When the ideas were placed within an analysing frame, it became apparent that the teachers were able to forward plan to integrate the ideas of the experts into their programmes and to describe their ideas on potential teaching content and student activities within a component.

It also became apparent that there was a gap in the teachers’ knowledge about foods thinking, particularly in an environmental context.

The aim of the focus group stage of the project was to determine whether it would be possible to develop an education programme that could deliver the components within the technology learning area of The New Zealand Curriculum (Ministry of Education, 2007). The participant teachers were able to discuss aspects of and relate the component to their current practice in technology education. The pedagogy of the teachers was reflexive as it considered ways in which components of food literacy could be combined into their food technology teaching.

Teachers felt that the components supported their teaching programme. The teachers were able to provide examples of integrating the ideas of the components into the technology curriculum that guided their current practice. In this discussion, they were able to suggest resources, approaches, key words and skills that they would use in their classroom to deliver an aspect of the food literacy component to their students.

Concern was raised over the level of detail in the component definitions offered. There was concern that there was a lot of room for interpretation by the teachers regarding the indicators of the students’ progression and success used to demonstrate their competency within a
component. There was also concern raised about the clarity and intent behind some of the terms used in the component phrase.

These findings are important as they express the views of the teachers about how they perceived the components of technological food literacy in classroom practice in Years 9 and 10. They also provide information on what the teachers thought was a consensus statement about what each component was in terms of subject content within their programme of food technology learning. It would be interesting to see whether the analysing frame could be used for a unit of work in a school environment.

To conclude this section, the food technology literacy education model has been presented (see Figure 8). The teaching and student activities have been located within the components of technological food literacy. An interesting finding was that teachers did not suggest activities for all components in the dimensions that were suggested from the literature. There could be a variety of reasons for this. The focus group teachers may have chosen not to speak about that aspect of the component but rather to speak about the lesson content and student activity with which they felt most comfortable. The dimensions and components may not have been in a subject area that was currently within their teaching pedagogy. This suggests that the populated food technology literacy model may be a model of technological food literacy that foods teachers can use to develop their pedagogy of teaching 21st century food literacy.
Chapter 6: Findings: Technological Food Literacy Pedagogical Content Knowing

6.1 Introduction

The attributes of a food literate person from a technological expert’s stance provided the framework for the theoretical food literacy model (see Figure 1). This chapter reports on the final research questions posed, “How is the food literacy model interpreted by foods teachers?” and “What are the implications for providing technological food literacy education for 21st century students?” In Section 6.2, the background to investigating this research question is presented. In Section 6.3, a pedagogical content knowing model for food technology (PCKgft) devised to analyse the teacher’s planning, developed from the populated food technology literacy model, (see Figure 6) is presented. Section 6.4 presents an analysis of the unit plans of three teachers who taught a component of technological food literacy as identified by experts using the PCKgft model. Section 6.5 considers the implications of providing technological food literacy education for 21st century students with an exploration of the PCKgft of these foods teachers using a model that integrates a view of Cochran et al. (1993) pedagogy and the PCKgft model. A summary is then presented in Section 6.6.

6.2 Exploring a model for technological food literacy pedagogical content knowing

The overall aim of this project was to investigate the attributes of a 21st century food technological literacy. It was intended that the attributes of an “ideal” food literate person would be identified by the experts, and that these attributes would then be developed into a model for teaching. To reflect the development of a 21st century technologically food literate person, it was expected that these attributes would be supported by the teaching of these components in a technological food literacy education programme. A way in which this teaching could be visualised is suggested by the food technology literacy education model (see Figure 8), in which the components are contextualised in teacher practice.

In exploring the teachers’ ideas about teaching a component of technological food literacy, it became apparent that the story of how to develop technological food literacy was much more complex than just an analysis of unit plans. Instead, the researcher recognised that a teacher’s voice through interviews and educational outcomes via student work needed to be heard in this analysis. Consequently, participant teachers were asked to reflect on how the components of technological food literacy could be taught and to provide student work to support their programme.
6.2.1 Suggested key components of technological food literacy

From open-coding the interview responses, several components of technological food literacy were identified as being of particular importance to a foods teacher’s pedagogy. The teachers identified particularly with four components of technological food literacy: Food hygiene (FH), Application of cookery skills (CS), Food preparation from scratch (FP) and the Sensory experience of food (SE).

In a description of how these components could contribute to a development of food literacy, Helen discussed and drew a diagram (see Appendix J Helen’s coat stand diagram) to explain the framework that underpins the hierarchy and complexity of interaction of these components:

“Like a coat stand. We give kids different things to anchor learning on. We live and breathe it, and these things come through in everything we do. So the stand is like the three things, which is your pedagogical backbone, which is food hygiene, cookery skills, food preparation. And building from that is sensory experience. And then we might have nutrition for whatever age group. And we might have, menu planning. But whatever they are doing, comes back to this solid base.”

Helen (exit interview lines 780–787)

Pippin described the teaching of food literacy to students in a similar way. She identified the situation of students arriving in her class with no prior food education and many components needing immediate attention. She had a chart and used it to point out the components when making this statement. This attention to essentials she identifies as follows:

“If someone comes in and they don’t know anything about food. Food preparation, you’ve got to teach them food hygiene, and how to cook things from scratch [Food preparation from scratch]. And the skills involved [pointing to Application of cookery skills]. Once they’ve got that under their belt, and you know what tastes good, looks good and you know what is acceptable [Sensory experience of food] then they can think about the cultural dimensions, the systems that underpin food production, wider community and industry. Then that can come.”

Pippin (exit interview lines 127–132)

Consequently, this complex interaction affected this teacher’s pedagogy.

Likewise, Samy framed her discussion in terms of the interaction of these components when she plans teaching for food literacy:

“I want the application of food hygiene. So I get them to practise, using the information, and linking. Essentially its personal hygiene, but you actually need to link in with the workings of food, to make that connection ... Food, and hygiene. Then they have to make a connection of how to handle the food [Application of cookery skills] to the hygiene.”

Samy (exit interview lines 46–50)

These comments suggested that there was a level of complexity and hierarchy in a foods teacher’s pedagogical content knowing (PCKg). It was apparent that the PCKg of foods teachers is complex and not only were more specific research questions needed to frame this analysis but
a model of food technology PCK_g was necessary to provide a framework for analysis of the complex pedagogy. The research questions that reflected this complexity are:

- What is the composition of a technological food literacy teacher’s PCK_g?
- What aspects of a technological food literacy teacher’s PCK_g do teachers demonstrate when teaching towards technological food literacy?

Three teachers who previously participated in the focus group discussions undertook further involvement in this research project by developing a food literacy teaching unit using the food technology experts’ lists of components of technological food literacy (see Table 8). These teachers participated in interviews that occurred during the planning, implementation and conclusion of their teaching. Also, they shared their teaching unit plans (based on a template shown in Appendix D) and provided exemplars of classroom tasks. Helen’s examples are found in Appendix K Helen’s unit plan and task documentation.

The open-ended interview questions that provided the focus of the discussion with these teachers (see Appendix C Initial indicative open ended interview questions) required teachers to reflect and comment on their pedagogical decisions when teaching for food literacy.

The analysis of their unit plan set the scene for the interpretation and enactment of a component of technological food literacy in the classroom, which is described in Section 6.3. Examples of Helen’s student work are found in Appendix L Helen’s student work exemplars.

### 6.3 Planning to teach a component of technological food literacy

The teaching programmes were analysed as follows. The first focus was to investigate how the teachers planned to integrate a component of technological food literacy into their teaching unit plans. Because these teachers taught food technology, they followed government guidelines for pedagogy in this curriculum area. Therefore, they were asked to use the technology unit planner from the on-line education resource community Techlink (n.d.) to plan their unit of work. The technology unit planner was developed in line with the technology assessment framework and the components of practices identified (Compton & Harwood, 2003) and was considered “best practice” for technology teachers at the time of this research. The technology unit planner provided the link between current practice and the ideas the teachers had about planning and implementing the teaching of a technological food literacy component (as identified by experts; see Figure 8).
A model to analyse the planning was developed by the researcher. The PCKgft model (Figure 9) shows the pedagogical activity occurring when teachers teach food as a technological outcome. It is designed to demonstrate the complexity of teacher input, when there is a technological focus and the components all interact. The model was populated with information from each teacher’s unit plan and linked to their current practice when they expressed their ideas about incorporating the teaching components of technological food literacy.

The external rectangular frame of the model acknowledges the original premise proposed in Section 2.2, that food is a technological outcome. For clarity and ease of reading, these words have not been placed on the diagram; this is symbolised by the external frame. Within the rectangle, there are two sections that these foods teachers paid attention to. The first is the **systems focus** underpinned by the Giessen Declaration acknowledgement that food education encompasses systems that draw on social, biological and environmental dimensions. It is proposed that the identification of these systems can broaden the foods teachers’ vision of the context that can be employed.

Because this pedagogy is strongly anchored with technological practice, the second major focus is **technological activity**. Both of these pedagogical activities are channelled by the teacher and this is represented by a funnel. Finally, because all pedagogy results in learning, the **anticipated student activity**, where food is considered a technological outcome, provides the objective for each teaching and learning experience. The ideas about the anticipated student activity came from the Techlink (n.d.) unit planning document, in which the teachers are asked to identify the “predetermined specific learning outcomes” and the “negotiated specific learning outcomes” (p. 2) in their unit plan, as well as information that came from the interviews when the teachers were asked to identify what activities the students were participating in.

These two dimensions of systems focus and technological activity are located as feeding into the funnel. Colours have been used to show continuity with models shown earlier in this thesis. The funnel is a representation of the teacher’s PCKgft. The dimensions and components the teacher initially indicated are shown in **bold**. The sections are coloured to keep continuity with the colours first displayed in Figure 5. The unit plan was analysed through the interviews, focusing on the systems focus and the technological activity that the teachers anticipated would occur. The components are shown in normal typeface. Arrows show the input of the systems/component and technological activity component in this learning situation. At the base of the funnel, the anticipated student outcomes that the teachers predetermined during their planning are indicated.
Figure 9. PCKgft model
6.4 The PCKgif of teaching a component of technological food literacy

6.4.1 Programme 1: Samy’s PCKgif

<table>
<thead>
<tr>
<th>Component</th>
<th>Teacher Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biological B/FH</td>
<td>Principles of preservation</td>
</tr>
<tr>
<td></td>
<td>Function of food packaging</td>
</tr>
<tr>
<td></td>
<td>Identifying high risk foods</td>
</tr>
<tr>
<td></td>
<td>Common food organisms</td>
</tr>
<tr>
<td></td>
<td>Harnessing microbes for food production</td>
</tr>
<tr>
<td></td>
<td>Biology of bacteria</td>
</tr>
<tr>
<td>Environmental E/FH</td>
<td>Function of packaging</td>
</tr>
<tr>
<td></td>
<td>Common food organisms</td>
</tr>
<tr>
<td></td>
<td>Ideal conditions for growth of micro-organisms</td>
</tr>
<tr>
<td></td>
<td>Sensory properties of food produced by use of microbes</td>
</tr>
<tr>
<td></td>
<td>Control microbial growth by altering environments</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Component</th>
<th>Teacher Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>CS</td>
<td>Making jam, relish and biscuits</td>
</tr>
<tr>
<td>SE</td>
<td>Taste testing activities</td>
</tr>
<tr>
<td>CT</td>
<td>Problem solving</td>
</tr>
<tr>
<td></td>
<td>Thermometer task</td>
</tr>
<tr>
<td></td>
<td>Role of sugar in foods</td>
</tr>
<tr>
<td></td>
<td>Role of pH in foods</td>
</tr>
<tr>
<td></td>
<td>Enzymatic browning</td>
</tr>
<tr>
<td></td>
<td>Biscuit mix tasting</td>
</tr>
<tr>
<td></td>
<td>Bread keeping experiment</td>
</tr>
</tbody>
</table>

| Key: |
| CS: Application of cookery skill  |
| SE Sensory experience of food  |
| B: Biological  |
| FH: Food hygiene  |
| CT: Critical thinking and decision making about food  |
| E: Environmental  |

Figure 10. Samy’s PCKgif
Samy’s lessons blended the biological and the environmental systems within the component of Food hygiene (B/FH and E/FH). The first focus on biological systems had a narrow focus of attention from this teacher, that is, micro-organisms and food. The second focus on environmental systems was also narrowly focused, on controlling the environment where the micro-organisms live. These foci of the two systems gave the component Food hygiene a context that was narrow and centred on control of the environment in which food micro-organisms could be controlled, in either food production or food preservation.

Samy illustrated the biological system and Food hygiene by teaching the principles of preservation and the function of food packaging with a practical activity in which the students made jam. The food item – jam – was a technological outcome because it utilised knowledge of micro-organisms and how to control environments, and skills and knowledge were woven within the cooking lesson. A class discussion was held about the role of sugar as a preservative, as well as the need to sterilise the jars to stop microbial action once the jam was bottled. The way the jam was sealed (with wax and a lid) was also discussed as a method for reducing microbial action and allowing the jam to be preserved for future use.

The environmental system and, in particular, Food hygiene was illustrated by an exploration of how food environments can be controlled to alter the food product. The students prepared slices of apple and placed them in different environments to investigate enzymatic browning, which can occur on cut apple surfaces (because of the interaction with oxygen). Students observed controlling the environment by placing cut apples in the air, under plastic wrap, and in solutions of sugar and salt, and then noting the changes that occurred. Samy commented:

“So all the way through there is a theme of controlling. Controlling things … Controlling, whether it be the warmth, the moisture, or the food content by acid, sugar, salt … the relish, the pH …”

Samy (exit interview lines 63–68)

Because Samy is a technology teacher, her lessons had a strong technological focus. Other technological activity components were added to her lesson structure. The students cooked, but these lessons were not focused solely on the cooking process. Samy developed their Critical thinking skills (CT) by using a range of food practices that challenged the students to not only develop a food product but to think critically about the food environments that were being developed in the recipe (CS) with the use of sugar, salt and changing pH (E/FH). The students also sampled food products that used micro-organisms in their production, which gave the food products particular sensory characteristics (SE), for example, tasting Yakuit and blue cheese. Samy held a strong belief that creating “hands-on” experiences for her students was important.
These lessons created opportunities for her students to learn by observation and activity, and to think critically about what change and control was occurring in the foods to increase their longevity (CT).

The activities students could experience are shown on the model as anticipated student activity. Samy commented that she wanted her students to experience the application of food hygiene (E/FH, B/FH, CS), and this emphasis can be seen in the technological activities that the students participated in. Samy commented:

“I want the application of food hygiene, so what I tried to do in this is to get them to actually practise using the information and linking.”

Samy (exit interview lines 46–47)

Samy planned student activities that included her students preparing jams and chutneys to explore the concept of altering food environments so micro-organisms would not survive. She also used these practical activities to illustrate the process of preserving using high temperatures/sealing preserves with wax and lids) so the food remained edible for long periods. She also used hands-on experiences of tasting food products and observation of bread kept in a variety of environments over time to illustrate how micro-organisms can affect food products. The final anticipated student outcome for this unit of learning was a pizza production line made using ingredients, firstly, that they had preserved (tomato sauce) and, secondly, that used micro-organisms in their production (a yeast-based bread base and cheese).

The PCKgft model was able to accommodate the teaching ideas that Samy discussed.
6.4.2 Programme 2: Pippin’s PCKgft

Pippin’s lessons had a simpler focus as she used just one systems focus. The biological system underpinned her unit, in which the focus was on the component Health-giving properties of food (B/H). In this situation, Pippin wanted her students to develop this knowledge alongside particular food development activities. So Pippin planned that the systems focus of health would be taught alongside technological activity, which focused on the students working with the component Application of cookery skills (CS), in which the students developed practical cookery skills and techniques. In this manner, Pippin’s ideas about the food technological outcome (healthy muffins, the menu planning for a family) helped to provide a focus on the technological activity that occurred.

Figure 11. Pippin’s PCKgft
Pippin initially indicated this tandem approach when first discussing her unit plan with the researcher:

“The introductory one [unit] with a practical focus running alongside a more theoretical one. The practical focus was developing skills, a range of different skills, and methods, and then, running alongside that was understanding the guidelines for healthy eating, and meal planning.”

Pippin (initial interview lines 136–140)

This unit was scaffolded with a student workbook that had been written as a collegial effort with teachers in Pippin’s food technology department. The characteristics of this teaching programme indicate the utilisation of Ministry of Health nutrition information (Ministry of Health, 2011a) and literature for teenagers, as well as development of the students’ food measuring basics and cookery skills.

Pippin’s planned teaching activities followed a traditional foods teaching idea in which nutritional health was the focus (B/H) and technological activity was undertaken by students developing cookery skills (CS). When Pippin planned the biological systems focus, she decided the focus would be on understanding food nutrients and how they support human body health. Justification for teaching the Health-giving properties of food (H) in this way, with a particular focus on nutrition, was underpinned by referring to the government guidelines Eating for Healthy Teenagers (Ministry of Health, 2011a) about teenage nutrition.

For example, in the student workbook the six nutrient groups and their functions are identified (B/H). How the nutrients react to the cooking process is discussed (CS). In this example, the student workbook refers to nutrients, particularly vitamins and their function in the body. A practical session followed in which the flash-frying technique was taught. This technique is used to retain the water-soluble vitamins in vegetables, which can leach out into the cooking water if the vegetables are boiled. There was a strong focus on nutrition; however, there was limited sociological input about the role of food habits and patterns that may have come into play from the students’ cultural backgrounds and food choices.

Although Pippin identified Application of cookery skills (CS) as important, the technological activity it produced was limited although informed by a high degree of critical thinking (CT) about the biological system health (B/H) focus that underpinned the unit. The technological food outcomes were limited to the brief that Pippin had set and the teaching and learning activities she led her students through to support their technological activity. This is best explained by the following example of Pippin’s anticipated student activities.
Here, the anticipated student activity included recording their diet (B/H), analysing it against the government recommendations (B/H) and then being challenged to think critically about it with a task sheet headed “How well did I eat?” (CT). Students were then required to complete a recipe, using their newly developed cookery skills (CS) to design and make a food product that better suited their needs.

Although Pippin planned for the unit to be enacted in a particular way, in which healthy eating (B/H) and meal planning would be supported by the students developing practical skills (CS), the learning was flipped and informed by the students being challenged to think critically (CT) about a situation. The students were guided to practically apply their critical thinking (CT) to a nutrition situation (B/H), which in turn drove the technological activity (CS) that occurred. For example, a design brief was given to the students that asked them to review (CT) the nutrient needs of their stakeholder (B/H) and design a suitable muffin recipe (CS) that met their needs. The PCKgft model (see Figure 9) accommodated this approach.

Pippin’s programme indicated that highly sophisticated planning underpinned her teaching. The teachers had brainstormed together to develop a programme that considered health aspects, cookery skills and recipe development. They also allowed space for students’ critical thinking when they provided a scenario for the students to use to develop their own brief, undertake recipe development and produce a final food as a technological outcome.
6.4.3 Programme 3: Helen’s PCKgft

Helen’s teaching had a strong technological activity focus. Helen had decided that this unit focused on a technological activity component, Menu planning and food purchasing decisions (MP). Helen identified that this component underpinned her “Home Alone” teaching unit. Helen
described the brief for this unit as being structured around a scenario that challenged her students:

“the challenge is, mum and dad have gone away ... here’s $20, look after yourself from Friday dinner time until Sunday lunch time, when mum and dad come home.”

Helen (exit interview lines 8–11)

When Helen talked about her teaching unit, it became apparent that Helen’s planning and anticipated outcomes were student driven and other components of technological food literacy informed her teaching practice. She identified these topics from the social system – Systems that underpin food (S/Sy), biological system – Health-giving properties of food (B/H), and environmental system – Systems (E/Sy), as well as several additional components of technological activity. Although Helen may have decided on a particular focus on Menu planning and food purchasing decisions (MP) when she asked her students to plan meals for a weekend home alone, other components of technological food literacy were also integrated into the learning. A focus on health (B/H) was evident when the students looked at their nutritional needs and analysed their planned meals against this. Systems (S/Sy and E/Sy) were discussed when the students went on a field trip to the local supermarket and learned about the systems that underpinned the supply of food into the supermarket as well as the manufacturing environment of the ingredients they might choose (E/Sy). Finally, critical thinking (CT) was identified when the students thought deeply about their home situation (S/Sy) and how that might affect their choice of meals. These interactions of components of technological food literacy informed Helen’s teaching practice about the Menu planning and food purchasing decisions (MP) component. Helen identified her preferences to teach her students to understand what drives our food decisions, but she taught this through a technological activity focus. She commented:

“To make decisions, about what they are going to buy, with that money available, but it must fit with the nutritional needs of a teenager. To do that they needed to be able to critically think about the issue. That arose, like a tag-on. Yes. Menu planning, but also health-giving properties, then the critical thinking sort of links in, like a bridge.”

Helen (exit interview lines 74–83)

Helen wanted these students to become aware of teenage nutrition needs (B/H) and expected her students to prepare meals that met those needs (MP, CS). The analysis of Helen’s programme indicated that the technological activity aspect of technological food literacy was given centre stage and drove the project.

The anticipated student activity for Helen’s students included first developing knowledge of food models such as the four food groups and the healthy diet pyramid (B/H) and then using this
information to analyse their meal planning (CT); being able to read food packages and their nutritional panels (E/Sy) and cooking and comparing packet food mixes with food prepared from ingredients (CS). However, as Helen worked with her students, unexpected teaching and learning outcomes arose. For example, she did not originally plan to take her students to the local supermarket. She planned to use a textbook to support her teaching about how people do their shopping. But when she taught this lesson, Helen realised that a lot of her students did not go to the supermarket and had little experience of participating in the weekly grocery shop for their families. As a result, Helen liaised with the local grocery store and took the students to the market with a supermarket investigation sheet to gather information that would scaffold their critical thinking and decision-making about their own menu plan.

Helen had prepared a comprehensive unit plan, “Home Alone” (see Appendix K Helen’s unit plan and task documentation), which included quite detailed lesson plan information and the experiences she felt would underpin her student learning. To deepen this account, Helen also prepared detailed lesson reflections into her unit plan at the end of each day, and modified the next lesson plan with strikethrough and highlighting, altering her set plans in response to her students. When asked why, Helen commented:

“I know I saw it differently when I first started, but now I realise the whole, critical thinking and decision making links to menu planning ... [Students say] ‘I could get this because it will meet my nutritional needs’, and that will involve some critical thinking. So it’s become really, really integrated. ”

Helen (exit interview lines 51–55)

Helen’s methodical and reflective approach to her teaching meant that she recorded these events and altered the lesson plans going forward to reflect these changes. This meant that additional technological activity components were added into her programme planning. The PCKgft model was robust and flexible enough to respond to these changes.

When Helen’s unit plan was placed into the model to analyse her planning, aspects of other components of technological food literacy that were not originally planned for in her five-lesson snapshot could be seen (see Figure 12. Helen’s PCKgft). The PCKgft model was robust and flexible enough to respond to these changes.

6.5 PCKgft mechanism

Gaining an overview of the teachers’ unit planning helps to understand how teaching a component of technological food literacy can be achieved. At this stage of analysis, the researcher wanted to find out whether a pedagogy, based on the socio-constructivist learning theories, could be used to interpret how food literacy for 21st century students could be
developed. The research question “What are the implications for providing technological food literacy education for 21st century students?” is explored in this section.

Pedagogical content knowledge (PCK) refers to a domain of content-specific teacher knowledge (Shulman, 1986). Cochran et al. (1993) extend the idea of PCK and suggest a model of pedagogical content knowing (PCKg), which emphasises a continual development of teacher knowledge. This idea of a dynamic relationship in which teachers might change their teaching in order to teach a component of technological food literacy was the lens through which the researcher chose to view this phase of the research. A pedagogical content knowing model in food technology (PCKgft) was developed that is underpinned by the ideas expressed in Cochran et al. (1993) and the ideas expressed in the populated food technology literacy model (see Figure 8).

The PCKgft model includes the four components knowledge of pedagogy, knowledge of subject matter, knowledge of students and knowledge of wider environmental contexts (Cochran et al., 1993). These four dimensions form four quarters of the PCKg model. In addition, there is a background spiral that represents the pedagogical action of the populated food technology literacy model funnel from a bird’s-eye view. The lilac colour of the spiral is the same colour indicated in the funnel in the populated food technology literacy model. The expanding, overlapping circles and arrows of the PCKg model, which indicate any change, growth or integration of the PCKg components (Cochran et al., 1993, p. 267), are also represented by the imagined spiral action in the background and the dashed lines between the PCKgft components.

The teacher activity in this central spiral forms the teachers PCKgft. Their PCKgft, using the components of PCKg, selects how the components of technological food literacy are enacted in the classroom.

![Diagram of PCKgft mechanism](image)

**Figure 13. Model of PCKgft mechanism**

Using the PCKgft mechanism model, the research questions investigated:
• the composition of a technological food literacy teacher’s PCKg (pedagogical content knowing); and

• the aspects of a technological food literacy teacher’s PCKg that these teachers would demonstrate when teaching a component of technological food literacy.

An analysis of their planning using the PCKgft mechanism model follows. The PCKgft mechanism models for Samy and Pippin are found in Appendix M Samy’s PCKgft mechanism model and Appendix N Pippins PCKgft mechanism model. Helen’s model is presented in this chapter in Figure 14. Their understandings about teaching a component of technological food literacy are presented as the four themes of Cochran et al.’s (1993) model: first, an analysis of the teachers’ perspectives on knowledge of pedagogy; secondly, the ideas about subject matter they accessed; third, the ways in which they gained knowledge about their students; and finally, their understanding of the wider environmental contexts in which the learning occurred.
Figure 14. Helen’s PCK gif Mechanism Model

Knowledge of Pedagogy
School educational goals
Our school really looks at our numeracy and literacy at Year 10 e357
I can link [pre and post tests] into the literacy requirements the school is asking of me e447

Unit planning, curriculum links and examination systems
Unit level – what is ok for teenagers e328
Its got to be about their depth of knowledge and that links in with the levels [of the curriculum] above, how you scaffold up e89
What level of the curriculum e407
Students doing external paper 1.6 next year e316
Scaffold to Year 11 e187

Classroom practice of teacher
Guided for web page research e233
Worksheet minimized from web information e269
Nutritional requirements of teenagers – serving size e144
Worksheets with pointed questions [supermarket visit] e353
Use of hindsight and follow-up e196
Prior learning – we need to know where they are at e405
I’ve always believed in the pre and post test idea e424
Scribbled it out as I went along, the other things that needed to be taught c177
Being receptive to their questions 1117

There’s no point in teaching it if they already know q117
All their knowledge will be shown in the depth of what they are answering 032
All the questions map to a specific lesson 031
I allocate out time allowances 0156
Be prepared to take risks with food 0395
It’s the critical thinking, but it’s also the planning. They are making something they want, is healthy for them, so it’s all sort of intermeshed 0396-7

It’s actually really guided. We didn’t just look at the website, we looked at what was behind the website e333

the canned tomatoes question, I asked them to look at three different product labels to see if they can find the three different countries of origin... I know we’ve done it in class, the [store] manager will mention it, and I’ve checked, there’s some there from Italy e359-61

Knowledge of Subject Matter
Teaching of technology knowledge
Understanding the brief e265
It comes back to the technological approach and making it real for them e626
Use the terminology whenever you can 1136
Hedonic scales e159
Specifications for colour e171

Teaching of food cookery skills
I know what you mean by cookery skills e654
As a foods teacher, knowing about the depth of skill and application to food, it [cookery skill] takes on a different meaning - 3 separate techniques to a process e656

Teaching of nutrition and food labels
Prices and products e53
Labels and nutrition needs e54, e93
Nutritional panels comparison e302
Serving sizes e331
Have a base of nutrition – whole food groups, serving sizes, menu planning e568

Knowledge of Wider Environmental Contexts
Wider contexts influencing teaching
Was it a useful, accurate [website, trustworthy, from government e225
Booking the library for access e217
Kids need to be IT literate e242
Have a data projector as a resource e265
Get them to realize “this is a real thing” e377

Influence of cultural teaching philosophy
“There’s so much that I’m still learning about teaching at this point... Becoming a Te Kaitakanga school, helped me reflect on what we are doing... whatever they want 154-59
It’s about the relationships you can make with the kids 172
The fact that it was my Maori boys [who actually got onto the work] which my school has particularly chosen to focus on, woeahh e128
It also brought in the Maori terminology [worksheets with maori] job titles on it] which is sort of what we are trying to do in school e154
It’s the whole environment of the classroom, having trusting and good relationships 164

Knowledge of Students
Learning strategies
Use a worksheet with labels – need controlled stages for students e274
That’s for my kinaesthetic learners e314
I can’t have full class discussions as the boys just aren’t on task e546
The students that stand out, they become my leaders e110

Abilities and developmental levels
It’s the type of kid we’ve got – they’re not at that level of the curriculum e410
Recognise the learning level of a 14 year old versus the inquiring mind of a level 1 student e507

Prior conceptions of subject/motivation
The “This is boring, I just want to cook” kids e70
[Nutrition] It’s not in their frame of reference e517

Knowledge of her students
Understanding that “Where’s my home? It’s not in the whare so I can’t just walk to a supermarket e587
We are talking about real food, but how much does a real tuner eat? e341
I allow them the ability to influence what happens in the classroom
They may not have been engaged with the topic, the nutritional needs bit too, high-faluting for them e130

Key: i = initial interview  o = ongoing interview  e = exit interview
Highlighted text shown in Ch 6
6.5.1 Knowledge of pedagogy

The knowledge of pedagogy aspect comprises knowing and setting educational goals, an ability to organise lessons and content, and the classroom practice of the teacher, teaching and evaluating this work (Cochran et al., 1993). PCKg also includes teachers knowing how particular ideas and concepts are presented to students (Zhang & Birdsall, 2016). Samy, Pippin and Helen identified that the teaching of food was taught practically. Quite often the practical activity was used as a conduit when other learning also took place. Samy described this practical activity as

“wanting them to practice the information and link it … teach personal hygiene, but get it to link in with the working with the food …”

Samy (exit interview line 47)

Helen described challenging her students to use up leftover stewed apple and how they came up with a variety of recipe ideas. Helen suggested that learning in foods is intermeshed:

“it’s the critical thinking, but it’s also the planning. They are making something, they want, … is healthy, for them. So it’s all sort of intermeshed.”

Helen (exit interview lines 396–397)

Pippin described practical activities as informing her students’ work in the component Application of cookery skills (CS) by encouraging them to

“practice till you get it perfect ... allowing them to practise a skill, is, good.”

Pippin (exit interview line 65)

Pippin felt that she structured her lessons around practical cookery skills. She described this part of her teaching as having

“A practical focus, developing skills, a range of different skills, and methods.”

Pippin (initial interview line 137)

The knowledge of pedagogy also includes knowing how to evaluate lessons (Zhang & Birdsall, 2016). The teachers often assessed the students’ competency by observation.

Samy simply said

“I watch them cook.”

Samy (ongoing interview line 85)

Pippin described herself as

“Observ[ing] the student is doing those things.”
Helen relied on individual questioning as a tool in her classroom practice to determine her students’ progress and competency. Helen believed that

“All their knowledge will be shown in the depth of what they are answering.”

The teachers were all able to suggest other teaching strategies that they would use. These teaching strategies often used the application of learned ideas to another activity. Samy used alternative assessment activities such as the creation of a pamphlet so she could see

“Depth, to their understanding, [which is] far greater than in a test. Apply their knowledge.”

Helen discussed testing her student knowledge from the food label investigation in class and asking them to apply it on the trip to the supermarket:

“the canned tomatoes question, I asked them to look at three different product labels to see if they can find the three different countries of origin ... I know we’ve done it in class, the [store] manager will mention it, and I’ve checked, there’s some there from Italy.”

Pippin’s teaching strategy was to incorporate a practical assessment using her students’ learning activities:

“seeing they wrote their own recipe for the muffins, I would get them to cook that. And I would assess them on their basic skills, management of time, product, and just their confidence and efficiency.”

It appears that foods teachers have a repertoire of techniques to find out how and what their students are learning. These foods teachers appear to scaffold learning with the use of practical activities and extend these experiences through applying the ideas learned to another task. Another particular characteristic of these foods teachers’ PCKg is the use of observation as a tool for assessment. When using observation as an assessment tool, the teachers indicated that they gained an understanding of how their students are developing their technological skills and knowledge in the production of a food artefact. They did not appear to be reliant on a summative assessment technique such as a written test at the conclusion of the project.

6.5.2 Knowledge of subject matter

The subject matter knowledge aspect comprises the teacher’s knowledge of concepts and content (Shulman, 1986) and how the teachers relate this in their classrooms (Cochran et al.,
In these food technology classrooms, the researcher was aware that teachers might hold two concepts in mind: one about technology teaching and one about teaching foods. All of the teachers held a common thread: that teaching about technology was an overarching umbrella from which their teaching of foods then developed. Helen enacted several aspects of technology teaching practice when she said

“It comes back to the technological approach and making it real for them.”
Helen (exit interview line 626)

Pippin’s comment also reflected ideas about teaching from a technological viewpoint. When discussing the student task of preparing a meal plan, Pippin identified that her students would

“need to be able to identify particular attributes that are important to their client.”
Pippin (initial interview line 93)

Samy extended the concepts taught about food hygiene into investigations into the role of bacteria in food. Her lessons were structured around a food preservation principle, which was then demonstrated in a practical experiment or food preparation technique. Her strategy was to illustrate to her students a deeper level of understanding about what was occurring when food preparation and preservation techniques were applied to food. Samy explained why she worked in this way:

“you have to understand what you are actually you are trying to do …”
Samy (exit interview line 265)

Pippin chose to focus on the Health-giving properties of food (H) component of technological food literacy in combination with the Application of cookery skills (CS) component. This focus also helped her to map to the focus on health (B/H) and cookery skills (CS) ideas expressed in the final technological food literacy model (see Figure 8). Pippin felt that the subject matter of these lessons provided her students with

“a range of simple skills that can be mastered within one lesson.”
Pippin (exit interview line 69)

Helen originally chose to focus on the component Menu planning and food purchasing decisions (MP). However, from her singular teaching focus at the start of her teaching, Helen’s PCKgf became more elaborate as the unit plan progressed. In discussions, Helen identified another five components of technological food literacy in her PCKgf (S/Sy, B/H, E/Sy, CS and CT) (see Figure 12).

She put this down to her classroom practice where she
“Scribble[d] it out as I went along, the other things that needed to be taught.”
Helen (exit interview line 377)

Helen was able to show that she incorporated the component Application of cookery skills (CS) in her lessons by teaching the specific skill of making a roux sauce when the students learned to make macaroni cheese. In discussing this practical, Helen particularly wanted to emphasise a food teaching principle in which three techniques were deemed to make a process. This idea originated from home economics practical examinations to ensure students were demonstrating a sufficient depth of skill. Helen commented that practical lessons were not just about making food, but rather relied, in part, on the knowledge of a foods teacher:

“As a foods teacher, knowing about the depth of skill and application to food, it takes on a different meaning.”
Helen (exit interview line 656)

It appears that foods teachers contextualise the subject knowledge they hold within a technological frame for teaching. The subject knowledge that the teachers select is that which suits the teaching focus at the time. This knowledge selection can be quite fluid, often in response to the feedback of working with the students. Helen’s PCKgft was very apparent as she moved alongside her students, reflecting on their progress and then selecting additional knowledge to share as the students synthesised the information into a technological outcome.

6.5.3 Knowledge of students

This knowledge of students component of PCKg acknowledges the knowledge that the teachers hold about their students. Cochran et al. (1993) suggest this includes knowing about their students’ abilities and learning strategies, developmental levels and motivators and the conceptions the students may hold about the subject (p. 266). All of the teachers expressed a deep knowledge of their students.

Helen prepared a lesson in which the class investigated the labelling on three boxes of breakfast cereal. In describing this lesson, she indicated that she had the boxes of cereal as well as a range of empty packets that the students could handle. She commented that this lesson, with a worksheet, was prepared for a particular student:

“for my kinaesthetic [student], the touching …”
Helen (exit interview line 314)

This demonstrated that Helen prepared her lessons in a manner that best met his learning style.
Samy also indicated an awareness of her students’ abilities when she discussed scaffolding a lesson about designing a pamphlet on food safety, in which she allowed

“*my boy who is dyslexic*”

Samy (exit interview line 200)

to complete the task using a computer and voice-activated software.

Pippin was able to describe particular characteristics that some of her students demonstrated:

“*Once you’ve got to know your students you’d know – they’ve never wiped a bench, cut an apple, girls that don’t understand as English is not their first language.*”

Pippin (exit interview line 319)

All of the teachers indicated that the students they taught demonstrated a motivation to be in class. For Samy and Helen, the theme was about the provision of food and cooking. Samy described food as being

“*a great motivator ...*”

Samy (initial interview line 140)

Pippin described her students as being motivated by creating:

“*They want to be creative.*”

Pippin (initial interview line 80)

The foods teachers got to know their students on several different levels. Firstly, they learned about their students’ learning levels and then adopted teaching strategies that they felt best met their needs. Pippin best described this as knowing

“*About the level of your students, and their interests.*”

Pippin (exit interview line 299)

Secondly, they were able to identify that the provision of food in a lesson was a powerful motivator for their students and harnessed this to teach particular concepts.

By the teachers’ harnessing their knowledge of their students, they were able to scaffold learning activities in food technology education that best suited their needs. They were able to use their interests as a starting point for learning. The PCKgft mechanism model reflects how they were able to incorporate this into their teaching practice.
6.5.4 Knowledge of wider environmental contexts

The wider environment is the final PCKg component and it considers the wider contexts within which the teacher operates and children learn. This can include the learning environment as well as teaching responses to surrounding “social, political, cultural and physical” (Cochran et al., 1993, p. 267) environments and acknowledging the diversity of students in New Zealand classrooms.

Samy reflected on the wider community in which her school was located. She felt she often lost students for periods of time as they were involved with the seasonal produce market gardens that surrounded her school community:

“I have students who went off to fruit pick for a term. Sometimes they come back again, sometimes not.”

Samy (initial interview line 210)

Samy also felt that her students could be quite diverse in ability. She reflected that often she was responsible for teaching disabled students and equipping them with life skills that would support their independence in the future:

“Some of my students will not get a job. But they develop life skills from being in my class, that they will use for the rest of their lives.”

Samy (initial interview line 232)

Pippin’s focus was on acknowledging the support of the students’ home environment. She felt that this could be a positive influence on her students:

“I think the home environment is important, if it supports what they do at school.”

Pippin (initial interview line 112)

Pippin’s school also ran a boarding hostel for students. Pippin reflected that she was aware of this context and how it may impact on the students:

“We have girls who live in the hostel. I need to be aware of their needs.”

Pippin (ongoing interview line 107)

Helen’s school had participated in “Te Kotahitanga” research project in the 2000s (Te Kete Ipurangi, n.d.), and the value gained from a narrative of student voice from a Māori perspective was still evident in Helen’s classroom and lesson plans. However, Helen also made some interesting comments about how her teaching was being shaped by the influences of this research project:

“There’s so much that I’m still learning about teaching at this point ... Te Kotahitanga helped me reflect on what we are doing ... I can see the kids reacting to me differently, I can relax a bit more ... I
can trust the kids to help guide me where we go. We have a partnership in learning. There is a whole thing about the environment of the classroom, and having good relationships, and trusting relationships, where they feel they can say whatever they want.”

Helen (initial interview lines 54–59)

Helen also reflected on the wider environment from which her students came and how this impacted on her teaching. She commented that she needed to understand that home location could be a constraint on her students’ work:

“Understanding that, ‘where’s my home?’ It’s out in the whops [isolated] so I can’t just walk to a supermarket.”

Helen (exit interview line 587)

Helen was particularly concerned about the wider influences that might be brought into play when she was teaching her students about information gained from the internet. She felt it was quite important that her students were able to navigate the IT tools in a critical thinking way. She commented:

“Kids need to be IT literate.”

Helen (exit interview line 242)

Helen had received a formal introduction through the Te Kotahitanga project and had continued to apply these principles to her teaching strategies. Samy, Pippin and Helen also commented on the wider contexts from which their children came, ranging from the challenges of being a boarding student in a hostel to the demands of a rural lifestyle, where the seasons of the year created additional expectations on their students. The foods teachers were aware of the wider environment and the contexts that these presented to their students. These teachers were able to discuss this wider view of environments and this has been accommodated within their PCKgift mechanism models.

6.6 Summary

In this chapter, the research question focused on how the food literacy model was interpreted by foods teachers.

An initial finding suggested that the teachers identified that some form of hierarchy existed within the components of technological food literacy and that some of these components were identified as being more important to a food technology teacher’s PCKg than others. Therefore, the teachers were able to display a deep knowledge of the subject matter that informed the components with a profound understanding of what was suitable for their students.
An initial analysis of the teachers’ unit planning was completed. In open-ended questioning, a focus was placed on the existing unit plans that the teachers had prepared and then developed further to incorporate teaching a component of technological food literacy within the existing New Zealand technology curriculum framework. These unit plans were placed within a PCKgft model, which analysed how the teachers’ planning (see Figure 9) linked to the food technology literacy education model (see Figure 8).

The results of this section relate to the categories of structure teachers place on the planning and management of teaching a component of technological food literacy.

Three different programmes of learning have been presented in turn. Each programme was selected by the teacher on the basis of their opinion of “best fit” between the unit planned and the components of technological food literacy shown to them in a focus group discussion.

Samy’s PCKgft focus was on the component Food hygiene (FH) and initially held a narrow focus on the environmental control and biological growth of bacteria in food. However, Samy held a strong technological focus in which food, as a technological outcome, was manipulated by human activity. These activities became the focus of her practically oriented lessons.

Pippin’s PCKgft focus was a tandem effort, with an interest in the Health-giving properties of food (H), narrowly focused in content within the biological system, and Application of cookery skills (CS). Pippin’s lessons followed a more traditional foods teaching construct in which the students were provided with the basis of knowledge in these two components. However, a technological focus was added when they were then challenged to critically think (CT) to produce a food item for a particular stakeholder.

Helen’s PCKgft focus was on technological activity, with Menu planning and food purchasing decisions (MP) informing her unit plan from the start. Helen’s lesson planning followed a more organic flow. In response to “teachable moments” generated in collaboration with her students, Helen’s teaching became highly reflexive, incorporating a wide range of components of technological food literacy into her teaching repertoire as the unit progressed.

If the teacher’s plans were placed in the PCKgft framework (see Figure 9), it became apparent that although teachers indicated they were teaching a specific component of technological food literacy, as their teaching progressed, other components of technological food literacy were drawn into the funnel of technological activity. For example, the framework analysis shows that all of the teachers incorporated the component Critical thinking and decision-making about food (CT) into their unit plan without an original intention to do so. The framework allowed for these
unplanned interactions to be discovered through the open-ended questioning process that progressed as the teaching programme progressed.

In the second part of the chapter, the interview responses were investigated to discover the composition of a technological food literacy teacher’s PCKgft. The interview responses were analysed against a PCKgft mechanism model (see Figure 13) and these have been presented as PCKgft mechanism models for Samy (see Appendix M), Pippin (see Appendix N) and Helen (see Figure 14), which linked to the ideas of Cochran et al. (1993) and the food technology literacy education model (see Figure 8).

The results of this section relate to the conceptualisation of a teacher’s pedagogy when teaching a component of technological food literacy. The four themes that inform PCKgft model have been presented in turn.

When considering the teachers’ knowledge of pedagogy, they all demonstrated very clear ideas about their classroom practice and how they would scaffold work in their lessons for their students. Their lessons were often practically focused and centred around experimentation with cookery skills. The students were then challenged to apply these skills and knowledge to different contexts. This approach appeared to be used to challenge and extend the students. This teaching technique was also used to determine if the students’ skills and knowledge were able to be transferred to different situations. The teachers often used observation and questioning to guide their classroom practice and these were used as a key assessment technique.

The teachers appeared to hold a rich depth of knowledge of subject matter. The teachers were able to demonstrate an ability to contextualise systems focus knowledge, behaviours and information, and access this supporting knowledge for classroom activities. It appeared that the food subject matter was often transferred to the students through the use of a technological teaching approach, often utilising practical, hands-on teaching ideas to transform this in the classroom.

The teachers also appeared to be knowledgeable about their students. They all sought to be responsive to students’ individual learning needs and identified different learning styles and abilities of students in their classes as well as strategies they would employ to engage and scaffold their students in learning activities.

When reflecting on the teachers’ knowledge of the wider environmental contexts, the teachers were outward looking and showed a level of awareness about external influences that affected
their students. There was mention of the living situations of the students and how this might affect their learning, and the role they played in educating students to prepare them for independent living. Mention must also be made of the programme to develop cultural awareness and how this had an impact on Helen’s teaching approaches. A dynamic relationship in which the teachers changed their teaching in response to the students and the wider environmental contexts within which they taught was indicated.

These findings are important as they express the PCKgft that was visible when the participant teachers shared their experiences of teaching a component of technological food literacy in their classroom. It is particularly important to consider the technological activity from the food technology literacy education model that enters the PCKgft (represented by the lilac spiral) as this informs and influences other aspects of the foods teacher’s PCKgft. This may provide information on what foods teachers may need to consider when incorporating components of technological food literacy in their programme of learning.
Chapter 7: Discussion and Conclusion

7.1 Introduction

The goal of this research was to examine and characterise food education for the 21st century through the opinions of experts, that is, those working with food and teachers. An examination of the related literature showed that there was no data to support findings about New Zealand teachers’ understanding of teaching for a 21st century technological food literacy. The few international studies that investigated teaching food technology – for example, that of Rutland and Owen-Jackson (2015a), was limited in application to their own country and context. Elsewhere, research on food literacy has focused on population health and the disadvantaged young (Vidgen & Gallegos, 2012). There does not appear to be any research on food technological literacy education and the components of food literacy that this education might refer to. It was hoped that a model for food literacy could be developed that would be accepted internationally.

An important underpinning stance of this thesis positions food as a technological outcome as a result of people’s interactions with it. This thesis argues an ontological viewpoint that the essence of people’s interaction with food directs it to be seen as a technological artefact. That is, the decision and process of transforming items to be digestible, non-poisonous and pleasurable food items that people consume involve a technological process of planning, design and transformation. Accordingly, it is suggested that the underpinning view of food for this research is the position that food is a technological outcome.

This research was positioned to meet a gap in the current research that provides a way to examine food as a technological outcome and suggest ways that technological food literacy could be characterised in a curriculum. Overall, the aim of this research was to investigate the attributes of food as a context in the 21st century in order to build a current model of food technology literacy education. The following research questions were investigated and will be answered in this chapter:

1. What are the attributes of a food literate person?
2. What components are deemed essential for a technological food literacy education programme?
3. What are teachers’ interpretations of the components of technological food literacy?
4. How is the food literacy model interpreted by foods teachers?
5. What are the implications for providing food technological literacy education for 21st century students?

The significant findings will be discussed with reference to these questions.

To provide a theoretical underpinning to these research questions, it was considered important to develop a model underpinned by a philosophy that created space to fully explore the rich complexity of food. The model needed to reflect the philosophy that food is a technological outcome as well as the dimensions of the model that were identified by the Giessen Declaration (Beauman et al., 2005) that show that food can be interpreted in terms of underpinning social, biological and environmental systems. Essence statements were developed that reflected this background (see Table 1). The essence statements provided the anchor that showed the important aspects of these theoretical underpinnings in the model. The researcher then developed a visual model (see Figure 1) that was underpinned by these essence statements to provide an accessible method to view the complexity of a food literacy. Consequently, instead of a definition, a model was proposed that allowed space for flexibility and contextualisation to be expressed.

7.1.1 Chapter structure

The first research question is answered in Section 7.2, where the attributes that these experts identified as food literacy components are discussed. In Section 7.3, the components of food literacy that these experts considered were the essential aspects about food that should be taught will be identified. How teachers interpreted the components of technological food literacy is discussed in Section 7.4 and how the teachers interpreted the food literacy education model is discussed in Section 7.5. The final research question is discussed in Section 7.6, where the implications of this research for the PCKgift of teachers providing food technological literacy education for 21st century students are considered. Section 7.7 identifies the significance of this research and Section 7.8 discusses its limitations. The suggestions and possibilities for future research are discussed in Section 7.9. Section 7.10 provides the concluding statement for this research.

7.2 The attributes of food literacy

The first research question was:

What are the attributes of a food literate person?
This question was significant because it was observed from teacher comments that more specific information was needed to guide teachers than the generic statements provided in The New Zealand Curriculum (Ministry of Education, 2007). It was felt that a broader and deeper view of food was needed in order to educate for food literacy. This thesis has argued that there was no food literacy definition in the New Zealand context that informed and supported educational programmes in food. It was decided to explore food experts’ opinions of the attributes of a food literate person.

To answer the research question, a theoretical framework was sought. The theoretical food literacy model (see Figure 1) provided the researcher with a generic tool to analyse the food experts’ ideas of the attributes that a food literate person might possess and compare them with the ideas suggested in the literature.

The findings of this research question are that:

- The attributes of a food literate person have been identified.
- Food education is so important, it should be available to all.

### 7.2.1 The attributes of a food literate person

The experts were selected as representative of the wide, diverse domain of food and were involved with food in their professional lives, or were teachers of foods. They were interviewed, and the results were analysed statistically to prove that their statements were relevant, valid and pertinent examples of food literacy attributes. The statistical analyses were as follows. First, the Cohen’s kappa statistic calculated the accuracy in identifying the attributes from the interviews, and second, the Delphi methodology provided a consensus opinion about them.

In Australia, Vidgen and Gallegos (2014) have also identified components of food literacy. It is apparent that their study and this author’s research have both similarities and differences in the defining and identification of components, and the suggestion of a model to describe food literacy. These will now be discussed.

Both projects recognise the importance of the Giessen Declaration (Beauman et al., 2005) as an underpinning construct to conduct research on food to identify the components of food literacy.

Both projects work towards identifying and defining what comprises food literacy. Vidgen and Gallegos’s (2014) findings identify food literacy as being highly contextual (p. 57) and their work focuses on a group of disadvantaged young people. This is a point of difference from this thesis. This study investigates food literacy from a wider, educational, technologically based
perspective. Initially, this thesis’s premise was that for food literacy to fully support the rich complexity of food, a robust underpinning philosophy that supports and reflects a broader perspective was required. To provide this underpinning view, this thesis synthesised the view of food from the Giessen Declaration (Beauman et al., 2005) and the philosophy of technology (de Vries, 2005). In addition, this thesis investigated food literacy from a wider educational perspective.

Consequently, this thesis offers an ability to visualise food literacy as a working model based on a wider, deeper philosophical base.

In answering the first research question, 10 components of technological food literacy were statistically determined (see Table 8). They can be located within a model that is based on a philosophical view about food, and this is presented in Figure 6. The 10 attributes were classified as dispositions, knowledge or skills.

A disposition was regarded as a personal characteristic or mannerism that people would display if they were food literate. The experts expected that food literate people would display a willingness to be innovative with their food, experiment with food preparation and be prepared to try new foods.

There were three attributes that were regarded as knowledge skills food literate people would display. First, food literate people would understand the cultural value of foods and how it can play a role of importance to themselves and the people around them. Secondly, food literate people would have the knowledge of the food systems that underpin our food. The last knowledge skill food literate people would demonstrate would be a knowledge of nutrition and how food has health-giving properties.

Finally, there were six skill-based attributes food literate people were thought to possess. First, the experts expected that food literate people would display critical thinking skills, and would be able to think wider and deeper about food, and act on that knowledge if they so choose. Second, food literate people would possess the skills of food hygiene. This attribute was considered to be the skills food literate people would utilise in order to keep their food in a safe and food-hygienic manner. Thirdly, food literate people would display menu planning and food purchasing skills. The experts anticipated that food literate people would be able to apply shopping skills to the purchasing decisions they made about food purchases. The fourth skill-based attribute was that of taste. Food literate people were expected to appreciate the sensory attributes of food. Fifth, food literate people would possess cooking skills. The final skill-based
attribute was that of learning. Food literate people were expected to be in possession of basic numeracy and literacy skills, so they could use these in their experiences with food.

The final list of the suggested components of technological food literacy is found in Table 6.

The second finding was that food education was for all.

7.2.2 Food education for all?

Another finding from this initial question put to the experts was that food education should be for all (see Section 4.3.1.1) When the components were being identified by Delphi, it was striking that the food experts identified that food education for all was important. They felt that food education “should be a basic requirement”.

Food education is already regarded as compulsory in New Zealand schools. Education about food is considered part of the health and technology curricula (Ministry of Education, 2007).

Therefore, it was considered that this was not an attribute of a food literate person, but rather an aspiration of future food literacy education. As a result, this attribute was removed from further discussions with the food experts.

7.3 Essential components of a technological food literacy programme

The second research question was:

What components are deemed essential for a technological food literacy education programme?

Further analysis using the Delphi was undertaken. The attributes needed to be developed into a teachable construct. How the focus was shifted from a personal attribute is identified in Figure 4 by the wording of a definition that exemplifies the attribute. The attribute was given a name that reflects the theme and subtheme that had been identified through the Delphi. Each component had a definition worded that followed a similar format – the nature of the attribute (be it a skill for a skill attribute, or a mannerism for a disposition attribute), the component name and examples from the experts of how the attribute would be seen as an aspect of the person’s behaviour. The final list of attribute themes, component names and the definitions they were given is shown in Table 6.

In the Phase One Questionnaire 2 Likert (shown in Appendix F), the focus was changed to an educational one. The attributes were identified as components and the experts were given
selection of comments from the Phase One Questionnaire 1 Likert answers to help identify the scope of the component. The experts were then asked to show their agreement level as to how essential they felt each component was in a food literacy education programme. A rigorous Delphi process followed, using statistical methods to identify the essentiality of the attributes. The data is strengthened by the use of a consistent method that is outlined in Chapter 3. This section of the research transformed the components of food to educational components. The findings showed that:

- broad educational concepts of literacy and numeracy and critical thinking can be taught within food technology education;
- the components of technological food literacy can be developed practically, and
- a model can explain the essential components of technological food literacy (see Figure 6).

7.3.1 Broad educational concepts visible in food education

The experts rated the broad concepts of education Use of literacy and numeracy skills (L&N) and Critical thinking and decision-making about food (CT) as being essential aspects of technological food literacy.

The experts explored these ideas being applied in the context of food education, often qualifying their ideas by indicating ways in which the skills could be used in a food situation. It is significant that the experts felt that critical thinking is an essential component of food literacy education. The experts considered it important that food literate people be given learning opportunities in food that challenged them to think wider and deeper about food and then be expected to act on that knowledge. For example, they felt that food literate people would be able to follow directions (for example, follow a recipe) but be also self-directed and determined to make recipe alterations if they chose. The literacy and numeracy skills were used by the experts as an indicator of critical thinking. The experts were also able to describe how they would express the skills of a food literate person in a document literate way; for example, a food literate person would be able to read food labels, read recipes and follow instructions to create a quality food product. Numerate skills, which identify reading and working with numbers, were the examples often given by the food experts. They felt a food literate person would be able to budget for food and make food purchasing decisions. Some problem-solving numerate skill examples were also suggested; for example, a food literate person would possess the skills to make shopping decisions with food when on a fixed income.
During the time of this research, these broad education ideas about providing New Zealand students with literacy, numeracy and critical thinking learning opportunities were highly visible in the public discussion arena (Johnston, 2016; Ministry of Education, 2010). It can be interpreted that these experts felt such educational ideas should be encompassed in components of technological food literacy and students would be able to develop criticality, maths and language opportunities within the food education curriculum.

However, the view of the foods teachers was that these aspects of education were already covered within their lessons (see Section 5.2.3). An overall aim of the New Zealand technology curriculum is to develop technological literacy in students in an experiential way, and with a view to developing their “informed criticality” (Svensson & Ingerman, 2010, p. 258). The research of Stables et al. (2001) also indicates that technology education is a method by which literacy and numeracy concepts can be taught. It could be useful to explore how the tasks technology teachers suggested achieved this goal.

### 7.3.2 Understanding of components can be developed practically

At this stage of the Delphi, the experts voiced a need for practical experiences of food. The experts felt that the components of food literacy could be developed in practical, hands-on food situations. It could be interpreted that the food experts reverted to a form of social conditioning about food education, sharing a narrative of “in my day it was different”.

The experts translated their ideas about food technological literacy education by referencing their experiences of learning foods with a practical cookery skill focus. While they held strong professional views of their current practice, they expressed an uninformed view of current food education in New Zealand where the basis of technology education is underpinned with criticality and understanding the functionality of product design. A lot of their interpretation reflected an idea of practical skill-based food production of “how to make” a product rather than considering that a food is produced in the true technological sense.

It was found that the food technology literacy model accommodated this practical viewpoint, but in a technological activity focus in which the component Application of cookery skills (CS) is used as a conduit for combining technological knowledge and volition with food systems knowledge. An example is when technological knowledge such as how to prepare food from scratch (FP) is combined with a personal volition – perhaps the person thinking “I’m feeling run down, so I need to eat healthy tonight” – and needing to think critically about how to solve the problem (CT) leads to an application of cookery skills (CS) through which the person makes a
meal solution that uses high-quality protein with a large variety of vegetables (to increase the nutrient quality and quantity). Rutland and Owen-Jackson (2015a) also suggest a practical focus as an aspiration of designing and making food products within food technology education; however, they note that the practicality is often exemplified as “how to make” cookery lessons rather than lessons with a design and make focus.

In contrast, this model is able to indicate a strong practical technological focus as the model has a philosophical underpinning of technology. In the example above, the person utilises a range of components of technological food literacy that contributes to a solution that better meets the person’s needs than producing a meal combining solution of a bag of salad mix with tinned tuna. The components provide the space to consider that volition may drive the development of a practical solution. The skill components contribute to the technological knowledge, empowering the development of a technological solution. The components provide a technology education focus for the teacher and this focus leads to practical activities being underpinned by a technological activity idea rather than a rote learning activity involving cooking.

7.3.3  The populated food technology literacy model

These research findings enabled the development of the populated food technology literacy model, and it was populated with the experts’ identified components.

Figure 15. The populated food technology literacy model, reproduced from Chapter 5
The populated food technology literacy model is a robust model for the following reasons.

The populated food technology literacy model is a visual expression of a complex ever-changing concept in which food is the context. This expression of technological food literacy needed to reflect not only that food is a technological outcome but that food influences and itself is influenced by social, biological and environmental systems. The strength of this model lies with the initial idea in which two theoretical frames are intertwined. The constructs suggested in the Giessen Declaration (Beauman et al., 2005) and the philosophy of technology (de Vries, 2005; Mitcham, 1994) provide the strong base that underpins this model. The social, biological and environmental systems that interplay in the complex world of food are shown as inputs into the populated food technology literacy model into a funnel at the top. The funnel diagrammatically suggests technological activity, showing the potential for it to act on aspects of these systems with the use of the skills described in the components of food literacy.

The populated food technology literacy model demonstrates how a deep technological understanding can underpin food education and enables the experts’ views about food technological literacy components to be expressed visually. Rutland and Owen-Jackson (2015a) indicate that the philosophy of technology should contribute to teaching technology but “we found it is rare to find in practice that it does” (p. 480). The populated food technology literacy model visually indicates a way to incorporate the philosophy of technology in food technology teaching. All aspects of the philosophy of technology are given a visual expression in this model.

The populated food technology literacy model also provides space to review the outcome of any technological activity where it can be evaluated in terms of its effect on the person, a population or the planet. The interaction of the effect of food on the person, societies and the planet is illustrated in this interactive model. The nested boxes at the base of the model show how an effect on one part of society can have an effect on another, and our world. The dynamic nature of the populated food technology literacy model is further reinforced by the feedback mechanism indicated, whereby the technological artefacts produced can feed back into the systems and technological practice. This is shown by the arrows to the side of the diagram,
showing a feedback effect of these technological artefacts into the social, biological and environmental systems at the top.

Aspects of the Giessen Declaration (Beauman et al., 2005) have been given depth with the inclusion of expert-identified components of food literacy, shown in the populated food literacy model. The philosophy of technology (de Vries, 2005; Mitcham, 1994, 2001) has also been characterised through the food context in the populated food literacy model. Through using the Delphi, the components that contributed to the development of a food literate person were identified. Through the use of a strong methodological research design, the components could quantitatively illustrate their key elements. As a further indication of the strength of this model, the populated food technology literacy model was then able to accommodate the components of technological food literacy identified by the experts.

The process of food becoming a technological outcome with all of the potential interactions has been given a visual expression. The workings of the model show the potential activity when food as a technological outcome is developed. The populated food technology literacy model reflects the dynamic technological activity that can occur as it utilises inputs from food systems; satisfies a need; combines with knowledge; and reflects the effects of its production on the person, populations and the planet. Compton and France (2007) emphasise the importance of recognising and understanding both objects and systems as part of a technological literacy. The populated food technology literacy model provides space for these inputs to be recognised and provides a model of food literacy from a technological perspective.

7.4 Teachers’ interpretations of the components

The third research question was:

**What are teachers’ interpretations of the components of technological food literacy?**

Twelve teachers of food participated in four focus groups to identify these teachers’ perceptions of the components of technological food literacy. The focus group activity was designed to determine whether it would be possible to develop an education programme, framed by the technology learning area of *The New Zealand Curriculum* (Ministry of Education, 2007) that could deliver the components of technological food literacy as suggested by food experts. Teachers identified particular activities that they felt were most effective in delivering these components (see Section 5.2). The teachers’ interpretations of each component of technological food literacy were used to populate the food technology literacy education model (see Table 8).
The findings from this research question suggest that:

- teachers were able to critique the components of technological food literacy.

### 7.4.1 Teachers critiquing the components

The food literacy components were strong and robust to withstand the critique of practising foods teachers in New Zealand. In the focus group discussions, the comments from the foods teachers were able to give further support to the arrangement of components within the model. Their interpretation reflected a wider view of food education rather than just viewing it as a practical skill. The food technology literacy education model was able to be populated with their teaching and learning ideas (see Figure 10), which is a further reflection of the model’s robust nature. The food technology literacy education model was strengthened through the teachers’ comments and accommodated the components of *The New Zealand Curriculum* (Ministry of Education, 2007).

The foods teachers were also able to reflect on the components of technological food literacy and describe ways in which they could link with *The New Zealand Curriculum* (Ministry of Education, 2007). Teachers used the components to illustrate their application in a range of programmes with a range of students. Therefore, the teachers felt that the components supported aspects of their current teacher practice, particularly recognising their tacit knowledge and the role of authenticity in technology education.

Tacit knowledge has been described as “that which is embedded in the subconscious” and “developed through practice” (Compton, 2004, p. 3). Focus group participants had an understanding about the importance of food. These teachers were able to bring together the ideas of experts (expressed as the components of technological food literacy) with their underpinning knowledge. The focus group teachers expressed an awareness of the importance of teaching the underpinning technological process that informs food knowledge as well as the skill of cookery. If food is thought of as a technological outcome, this creates a different viewpoint from which to consider food. The teachers felt that the components of technological food literacy reflected “talk we all understand” (Focus group A, line 223) and that the identification of this broad base of components gave their professional presence credence and a sense of value.

Authenticity in learning environments is an important aspect of sociocultural learning approaches and this idea is supported by Turnbull’s (2002) research. These foods teachers felt their ability to access the authentic in their teaching practice was supported by the components of technological food literacy as they offered explicit concepts about food that were “realistic.
topics” (Focus group D, line 109) about “real issues and real decisions” (Focus group A, line 163).

The food technology literacy education model (see Figure 8) was able to reflect the conceptual indicators suggested by the teachers as examples of the components of technological food literacy in action, as either suggested teacher or suggested student activities. This further strengthens the food technology literacy education model as it indicates it may work as a working educational model to inform teacher practice.

This analysis is significant because these teachers were able to provide educational justification to the ideas of these experts and suggest support and alterations to their ideas. Firstly, the teachers were able to suggest teaching strategies and student learning activities that could be used when teaching a component of technological food literacy. Secondly, the teachers were able to suggest alterations to the components that moved them from an exterior expert view to teacher-driven concepts. For example, there was the suggestion that the component Cultural dimension and significance of food (Cu) title needed to be altered to state the “Cultural dimension and social significance of food”, and the component Sensory experience of food (SE) descriptor needed to be altered to include the experiences of other senses besides taste. These findings suggest that while the components provided capacity to accommodate the teachers’ pedagogy, the position of the teachers also could inform the components in a way that reflected current classroom practice.

Furthermore, the analytic frame also showed gaps in these teachers’ interpretations of technological food literacy. For example, there was only one teacher activity example generated for the environmental systems aspect (see Figure 8). The food technology literacy education model provides an opportunity for teachers to consider the environmental aspects of technological food literacy. This finding suggested that teachers may need to develop an understanding and awareness of the intent behind the components of technological food literacy and that this requires some level of professional development.

The thesis findings suggest that the food technology literacy education model provides a robust analytic tool that can be utilised to show teachers the broad and wide dimensions of teaching for teaching for 21st century food literacy.

7.5 Interpreting the food literacy education model in a teaching programme

The fourth research question was:
How is the food literacy model interpreted by foods teachers?

Three teachers interpreted the food technology literacy education model in a teaching programme. The teachers developed a teaching unit that incorporated a component of technological food literacy within their programmes. The teaching units were analysed through document analysis and open-ended questioning.

It was found that the food technology literacy education model created a strong scaffold for the teachers to incorporate a component of technological food literacy within a unit plan and gave them permission to be selective and focused in their teaching. Their interpretations showed that it was possible to use the food literacy education model in tandem with The New Zealand Curriculum (Ministry of Education, 2007. As a result, the food technology literacy education model is further justified as a robust model because it provided a framework for enactment of teachers’ unit and lesson planning.

The findings of this research question suggest that:

- the food technology literacy education model provides a scaffold for teacher planning, and
- there is a perceived hierarchy to the components of technological food literacy.

7.5.1 A scaffold for teacher planning

The food technology literacy education model was developed further as a PCKgft model (see Figure 9) in which the information from teaching a component of technological food literacy could be shown. As a result, the model includes the conceptual indicators suggested by the teachers as examples of the components of technological food literacy in action, as either suggested teacher or suggested student activities (for example, Helens PCKgft model; see Figure 12).

Although teachers had originally planned a unit of learning that was not initially designed to reflect a component of technological food literacy, using the PCKgft model made their planning more selective and focused. This change occurred because these teachers were given the space to select components as well as the freedom to choose a scaffold for planning and teaching a component of technological food literacy. The teacher’s pedagogy was reflexive enough to recognise “teachable concepts” in the component that they felt added some value to their students’ learning.
When unit and lesson planning was placed within the PCKgft model, it became apparent that teachers were able to use the model as a scaffold for their planning to bring aspects of the component of technological food literacy to the fore. The components provided the teacher with permission to investigate the ideas of the components of technological food literacy. Furthermore, the PCKgft model was flexible enough to indicate the interactions that occurred. This provided further evidence of the strong, robust nature of the food technology literacy education model as the PCKgft model originated from this model.

7.5.2 *Hierarchy of the components of technological food literacy*

An interesting finding was that the teachers indicated that several components of technological food literacy were identified as being of particular importance to a foods teachers pedagogy. These were Food hygiene (FH), Application of cookery skills (CS), Food preparation from scratch (FP) and the Sensory experience of food (SE) (see Appendix J Helen’s coat stand diagram). The significance of this analysis appears to lie in the sense of validation the teachers felt for their role as foods teachers as they felt there was specialist knowledge they could impart.

The Delphi indicated a statistical hierarchy that made links between what the food experts identified and what the teachers reiterated from teaching with the food technology literacy education model underpinning their planning. The food technology literacy education model provided the space and freedom for the teachers to enact the components. The teachers were able to contextualise and reiterate the specific aspects of food technological literacy indicated by the components. It is important to note that the food technology literacy education model provided the opportunity for the components to be taught in different contexts by the teachers, thereby emphasising the idea that there is not just one way of teaching the components of technological food literacy.

7.6 **Implications for teaching – Development of PCKgft mechanism models**

The fifth research question was:

*What are the implications for providing food technological literacy education for 21st century students?*

It was decided to explore the pedagogy of the three practising teachers to provide a detailed, rich description of the pedagogy required to teach a component of technological food literacy. It was anticipated that by exploring the pedagogy, any implications for teaching food technological literacy education would be illustrated.
A model for technological food literacy education pedagogy was proposed (see Figure 13). The reason a model for pedagogy is important is that it informs on how subject matter is transformed by the action of the teachers (Cochran et al., 1993). The subject matter was identified as the components of food technological literacy pertinent to exploring ideas of pedagogy and developing a model for technological food literacy.

The analysis for this question was underpinned by the ideas of Cochran et al.’s (1993) pedagogical content knowing (PCKg) model. An influencing factor in choosing the stance of Cochran et al.’s (1993) PCKg model was that it is based on the constructivist approach to learning, which also underpins the direction of The New Zealand Curriculum (Ministry of Education, 2007). As this research is positioned in the New Zealand classroom, the researcher decided this was a valid position from which to interpret the practising teachers’ pedagogy.

A pedagogical content knowing model for food technology, the PCKgft mechanism model (see Figure 13) based on Cochran’s (1993) model of PCKg and the food technology literacy education model (see Figure 8) was developed as an analysis tool. The use of this tool enabled the researcher to analyse the content and type of teacher PCKgft. Using the PCKgft model meant that a consistent approach to the interview data could be undertaken.

The findings of this research question suggest that:

- the PCKgft mechanism model provides the framework for a detailed analysis of PCKgft, and
- a deep, complex and conceptualised PCKg for foods teachers when teaching a component of technological food literacy is possible.

### 7.6.1 PCKgft mechanism model can show the complexity of technological food literacy education

This research illustrated how a PCKgft is enacted.

The development of the PCKgft mechanism model enabled the researcher to analyse teacher’s data about the whole-of-experience teaching practice that the teachers spoke and wrote about during the course of the research project. The model enabled the researcher to conceptually frame teacher practice in a manner that recognised the many components of teacher practice and pedagogy (Cochran et al., 1993) and the teacher knowledge about the components of technological food literacy.
Upon reviewing the teacher’s planning and interview data it was shown that these teachers held a broad conceptual view of the interacting knowledge that underpinned their foods teaching. This view could be demonstrated by the PCKgtf mechanism model.

Through the use of the PCKgtf mechanism model it has been shown that foods teachers can employ a rich, broad pedagogy which can harness their content knowledge of and about food.

The thesis findings show that PCKgtf mechanism model provides a conceptual frame for food technology education. It is suggested that the PCKgtf mechanism model is robust and can accommodate many perspectives. In particular, it is suggested that the PCKgtf mechanism model can illustrate a foods teacher’s pedagogy and show how teachers synthesise and transform the food knowledge indicated by the components of technological food literacy. The PCKgtf mechanism model also provided space for reflection on student’s technological activity to inform teacher practice.

7.6.2 A deep conceptualisation of food technology teacher pedagogy

This analysis confirms findings of Cochran et al. (1993) as the teachers were able to demonstrate their knowledge of subject matter and their pedagogy when teaching about the components of technological food literacy. They were also able to show knowledge of their wider environment and their students in tailoring teaching and learning tasks in technological food literacy.

The thesis has illustrated the conceptualisation of a teacher’s pedagogy when teaching a component of technological food literacy through the use of the PCKgtf mechanism model. The PCKgtf mechanism model has provided a deep, complex and conceptualised description of food technology teacher pedagogy. The PCKgtf mechanism model was flexible enough to reflect the choices and interactions that these teachers made. The dimensions of teacher practice became more apparent as the teachers discussed how they could visualise the components in practice in the classroom. In some cases, the student voice led the teacher to alter their PCKgtf. For example, Helen and Samy altered their teaching programme in response to the needs of their students. The fusion of teacher and student ideas enabled the teachers to transform the subject content suggested within the component of technological food literacy and present it in ways that better suited the individual learning needs of the student concerned. This finding is significant as it moves forward the ideas of a technology pedagogical framework for New Zealand food education.
7.7 Implications and significance of this research

This research project makes two contributions to research in the area of food technology education:

- the construction of tools that describe the components of a technological food literacy education, and
- the construction of the PCKgft model which can inform the pedagogy of food education teachers.

7.7.1 Construction of tools

The first contribution is the construction of two tools that describe the components of a technological food literacy education. The tools enabled the researcher to structure a way in which the underpinning knowledge of the dimensions of new nutrition science and the philosophy of technology could be visualised in food technology education.

The first tool, the food technology literacy education model (see Figure 8), was initially proposed using the literature (see Figure 1). It was constructed using the categories indicated from the underpinning knowledge of the dimensions of new nutrition science and the philosophy of technology. The model was then populated (see Figure 6) using the views of food experts and teachers. The model underpinned the PCKgft model (see Figure 9), which reflected the complexity of teacher input when planning to teach food as a technological outcome. Populating the model confirmed its robustness, and the researcher could triangulate the data from food experts and teachers in order to identify the components of technological food literacy and their definitions (see Table 8).

The second contribution to food technology literacy research made by this research project is the PCKgft mechanism model (see Figure 9). The development of the PCKgft mechanism model enabled the researcher to analyse teachers’ data about the whole-of-experience teaching practice that the teachers spoke and wrote about during the course of the research project. The model enabled the researcher to conceptually frame teacher practice in a manner that recognised the many components of teacher practice and pedagogy (Cochran et al., 1993) and the teacher knowledge about the components of technological food literacy.

These two tools could be used in further research or teaching. For example, the food technology literacy education model (see Figure 8) and the PCKgft model (see Figure 9) could be used by teachers to inform their planning as they recognised the inputs for food systems thinking,
technological activity and anticipated student activity. This model enabled them to link closely to a suggested unit planning format that is used in New Zealand technology education. In addition, the food technology literacy education model could be used by other researchers seeking a theoretical frame to analyse pedagogy.

7.8 Limitations of the study

A theoretical model has been presented which has been populated with the ideas of 24 food experts. The education model has been considered by 12 practising secondary school food technology teachers and trialled by three experienced, practising secondary school food technology teachers in New Zealand. The model reflects complex ideas and appears to be versatile for use by foods teachers. It would be appropriate to discover whether this model can be applied to different contexts and different countries.

7.9 Suggestions and possibilities

Assuming that food is a technological outcome is an underpinning concept to the provision of a model of technological food literacy education that may enable foods teachers to develop their pedagogy.

This research project suggests that the process of teaching components of technological food literacy reflects a deeper base of pedagogy in food technology education than just the mechanism by which teachers teach cooking skills. One further area of interest that emerged from this research project is how to consider the evolving nature of the PCKgt: the teachers undertook to teach a component of technological food literacy, but then adapted their practice to include other components as the teaching of the unit developed. This exploration could be achieved by following foods teachers in more detail and observing the transformative process that occurs as progress through the teaching unit is achieved.

The research has had a transformative role for me and the participant teachers in two key areas. First, in terms of my own teaching practice, this research has played a role in my thinking and planning about which aspects of food would be incorporated into teaching units. Secondly, it has played a role in developing a forum for discussion for the food technology teachers involved in this research. Hopefully, being involved in a research project has created some future thinking about food education, and the sharing of these ideas, for the teachers involved.
7.10 Concluding remarks

In conclusion, this research has explored the attributes of a 21st century technological food literacy in order to build a model of technological food literacy education that can inform foods teachers’ pedagogy. The findings showed that components of technological food literacy can be identified. These in turn linked to a model for food technology literacy that was informed by literature about food and the philosophy of technology. The project illustrated how food experts were able to reach consensus on their ideas on the attributes of a food literate person and these developed into the components of a technological food literacy.

This project also explored how identifying the components of technological food literacy provides contexts for food technology teaching. The project illustrated how practising teachers translated their understanding of the components into their pedagogy. These teachers appeared to translate their understanding of the components in terms of their underpinning background content knowledge. They then considered the knowledge they held of their students, the wider school environment and particular pedagogical approaches while planning to teach a component of technological food literacy. The utilisation of a component and its underpinning constructs in the dimensions of food or in the philosophical dimensions of technology illuminated their PCKft. Teachers identified with the ideas of these experts with the suggestions of technological food literacy components. When the teachers practised teaching a component of technological food literacy, they were able to respond and change their teaching to reflect the key messages within each component. They were able to teach with additional components of food literacy and their resulting PCKft was able to reflect these ideas. It is proposed that an understanding of the components that are important to consider in a food literacy education programme could contribute to the development of food education for the 21st century.

My education in food and nutrition began years ago. Nurtured in rich cultures where food was a communicator and a comfort, brought up with the harsh reality and the economic necessities of farming, trained to be passionate about nutrition and health, and concerned about obesity, I have winced at the stresses that food insecurity can bring and been quietly shocked by the lack of food awareness people can demonstrate. Food education has been important to me because it has opened windows and doors in my world. I consider that food education is important to others because of the potential it holds and is a fabulous subject to teach because of the rich pedagogy that it employs. To equip 21st century learners for their future, I believe that teaching and learning should look different from what education has been like in the past. This project has highlighted what may constitute food content knowledge in 21st century food education. And education, as Nelson Mandela described:
“is the most powerful weapon which you can use to change the world.”

Nelson Mandela

23 June 1990
Appendices
## Appendix A Defining the experts

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</table>
Appendix B Indicative Focus Group Questions

Project Title: Food Literacy for the 21st Century

Researcher: Wendy Slatter

Ten components of food literacy have been introduced. For each component of food literacy, I would like you to consider the component and its corresponding definitions and please respond to the following…

- Are there any components that you already teach?

- How do you teach them? What context? How long? Why are they important?

- Are there any components that you have not considered teaching? If so why not?

- If you were given a list of these components to teach which ones would you consider really important and why?

- If you had to leave any of these components out which ones would you omit and why?

- What problems can you see when thinking about teaching these components?

- These components have been considered essential to an education for food literacy. Are there any obvious links that you can see within this list? For example for a year level or a particular focus like health, technology education or hospitality?

Approved by the University of Auckland Human Participants Ethics Committee on 2 Dec 2011 for 3 years
Reference Number 7705
## Project Title: Food Literacy for the 21st Century

**Researcher:** Wendy Slatter

<table>
<thead>
<tr>
<th>Component of Food Literacy</th>
<th>Definition</th>
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</thead>
<tbody>
<tr>
<td>Food hygiene</td>
<td>The practice and application of skills with food that a 21st century food literate person may display include hygiene – the application of food hygiene rules and guidelines.</td>
</tr>
<tr>
<td>Application of cookery skills</td>
<td>The practice and application of skills with food that a 21st century food literate person may display include cooking – the application of cookery skills to food.</td>
</tr>
<tr>
<td>Food preparation from scratch</td>
<td>The disposition or personal characteristics or mannerisms that a 21st century food literate person may display include an ability to be innovative and try things, for example, try a new food, work without a recipe, be authentic e.g. prepare food for a real family.</td>
</tr>
<tr>
<td>Use of literacy and numeracy skills</td>
<td>The practice and application of skills with food that a 21st century food literate person may display include learning – in possession of basic numeracy and literacy skills.</td>
</tr>
<tr>
<td>Sensory experience of food</td>
<td>The practice and application of skills with food that a 21st century food literate person may display include tasting – experiencing food in a sensory way, knowing how foods should taste.</td>
</tr>
<tr>
<td>Knowledge of the cultural dimension and significance of food</td>
<td>The knowledge or literacy skills that a 21st century food literate person may display includes the knowledge of culture – knowing the role that food plays in the rituals and practices of particular groups in a society, an ability to recognise that food has an importance to oneself, and that food has a cultural dimension and significance.</td>
</tr>
<tr>
<td>Knowledge of the systems that underpin food</td>
<td>The knowledge or literacy skills that a 21st century food literate person may display includes the knowledge of food systems – the systems that underpin our food such as growing, distribution, retail, additives, processing, food labels.</td>
</tr>
<tr>
<td>Menu planning and food purchasing decisions</td>
<td>The practice and application of skills with food that a 21st century food literate person may display include shopping skills – the practice and application of shopping skills to the purchasing decisions about food.</td>
</tr>
<tr>
<td>Component of Food Literacy</td>
<td>Definition</td>
</tr>
<tr>
<td>----------------------------------------------------------------</td>
<td>---------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Knowledge of health-giving properties of food</td>
<td><em>The knowledge or literacy skills that a 21st century food literate person may display include the knowledge of nutrition – the study of the health-giving properties of our food.</em></td>
</tr>
<tr>
<td>Critical thinking and decision-making about food</td>
<td><em>The practice and application of skills with food that a 21st century food literate person may display include critical thinking – being able to think wider and deeper about food and act on that knowledge.</em></td>
</tr>
</tbody>
</table>

Approved by the University of Auckland Human Participants Ethics Committee on 2 Dec 2011 for 3 years
Reference Number 7705
First Question:

So, what I want to know is...what springs to your mind...

What do they think of the model?

- Why do they think that way?
- Is it a practical model?
- Is it realistic model?
- Is it pertinent to Years 9 and 10 FTE?

Second Question:

What is your view or perspective on the model?

From your position as a FTE teacher...What does this model offer as a different perspective to your ideas about food literacy?

- Is there anything new to you as a FTE teacher?
- What’s your opinion of these ideas?
- Do you have a slightly changed slant/new perspective on teaching FTE as a result of this model?

Third Question:

How would they enact this Essential Food Literacy Component Model in the classroom?

I now want to look at classroom practice.

I’d like you each to choose a component that you do now, and explain how you do it in the classroom. If you think that you don’t teach any of these now, choose one that you think might be able to be taught or create a teaching unit around and tell me...

- What influences you in your choice of food literacy components?
- What approach might you use to teach this?
- What resources do you think you need to teach this component?
- What important language might you teach?
- What topics might you cover?
- Which skills would be important to teach within this component?
Appendix C Initial indicative open ended interview questions

School of Science, Mathematics and Technology
The Faculty of Education
University of Auckland
74 Epsom Avenue
Auckland
Ph: 09 623 8899 ext 48439

Food Literacy for the 21st Century

Researcher: Wendy Slatter

Indicative Open Ended Questions to Initiate Discussion about Food Education for the 21st Century

Food Expert Interviews

• Tell me about your involvement with food...

• What do you think are the important concepts that our future students need to know about food?

• Why do you regard these concepts as important?

• What is your wish-list of personal skills that a food-literate 21st century citizen would possess?

• Why do you regard these skills as important for the future?

Approved by the University of Auckland Human Participants Ethics Committee on 15 October 2009 for 3 years

Reference Number 2009/427
Initial Indicative Open Ended Interview Questions

Teachers

Project Title: Food Literacy for the 21st Century

Researcher: Wendy Slatter

- How would you describe your philosophy about teaching foods education?
- Please describe how you think students’ best learn.
- How does this view of learning underpin your teaching?
- Why have you chosen this Component of Food Literacy (.....) to work with?
- How do you interpret the Component of Food Literacy (....) to be taught in the classroom?
- Why are you thinking the teaching of this Component of Food Literacy should be developed in this way?
- Show me how this Component of Food Literacy would look like in the classroom (introduce ‘Teacher Planning Sheet Template’)
  - Are there any special characteristics of the students we are teaching this to that we need to be mindful of?
  - Are there any safety, rooming and resourcing limitations we need to be mindful of?
  - What context do you think this could be taught within?
  - What learning outcomes are there to be?
  - What activities would you choose to do?
  - Why do you particularly choose these activities?
  - How would you assess these learning outcomes?
  - What makes these learning outcomes different to others you may use within this context (rather than from the stance we are taking from a Component of Food Literacy viewpoint)?
  - Please remember to annotate this planning sheet as we progress, it is to be a living document – do you have any questions about using this teaching planner we have developed?

Approved by the University of Auckland Human Participants Ethics Committee on 2 Dec 2011 for 3 years
Reference Number 7712
Ongoing Indicative Open Ended Interview Questions

Teachers

Project Title: Food Literacy for the 21st Century

Researcher: Wendy Slatter

- What teaching did you do today?
- What resources did you use?
- What were the highs of today’s lesson?
  - What were they?
  - How were they caused?
- Were there any lows of today’s lesson?
  - What were they?
  - How were they caused?
  - How did you cope with these?
- How do you think the work is going?
- Any changes that you think we need to make to the teaching plan overall?
  - Why do you think that?
- Have you remembered to annotate the teaching planner for me?

Approved by the University of Auckland Human Participants Ethics Committee on 2 Dec 2011 for 3 years
Reference Number 7712
Exit Indicative Open Ended Interview Questions

Teachers

Project Title: Food Literacy for the 21st Century

Researcher: Wendy Slatter

- How have you found the experience of working with a component of food literacy?
- In the first interview I asked you about your philosophy about teaching foods education.
  - Does this teaching snapshot mirror your philosophy? Why/Why not?
- How have you found the experience of working with a component of food literacy?
- Describe for me the significance of this component for your students.
  - Why do you think this?
- What aspect engaged the students?
  - How could you tell?
- When did you feel that learning was occurring – what showed this to you?
- Do you think there are similarities with the component of food literacy you taught and the curriculum you work with – or is there a difference?
- Were there any issues in teaching food education from this focus that you experienced?
  - Can you describe these and give examples?

Approved by the University of Auckland Human Participants Ethics Committee on 2 Dec 2011 for 3 years
Reference Number 7712
Appendix D Teacher Planning Template

Teacher Planning Template

Project Title: Food Literacy for the 21st Century

Researcher: Wendy Slatter

TECHNOLOGY UNIT PLANNER EXPLANATION OF TABLE ENTRIES

Description of Context
In this section an outline of the context should be provided as a general overview within which the learning experiences will be situated.

Class description/Students Past Experiences
In this section information available that is relevant to this unit regarding students’ prior experiences and/or interests should be noted. It is also the place that a summary of the students’ current level of achievement in terms of the technology components being focused on as based on previous units should be noted.

Key Focus: Component/s of Technology underpinning unit
The technology curriculum component/s being focused on in this unit should be identified here. These will then be developed into curriculum-driven, predetermined learning outcomes and ultimately used to report on student progression as related to the achievement objectives. Learning experiences will be developed in keeping with these foci, alongside that identified in the context specific foci, and subsequent negotiated learning opportunities.

Terminology embedded within component focus
Note down key words that students should be familiar with by the end of this unit in relation to the identified components. Learning experiences should be developed to provide opportunity for students to explore these terms and employ them in their work.

Key Focus: Context specific skill/knowledge
The key skill and/or knowledge critical for student success as part of this unit should be identified here. These will then be developed into context driven predetermined learning outcomes. Learning experiences will be developed in keeping with these foci, alongside that identified in the curriculum foci, and subsequent negotiated learning opportunities.

Terminology of specific skills and knowledge (literacy development)
Note down key words that students should be familiar with by the end of this unit in relation to the identified context specific skills and knowledge. Learning experiences should be developed to provide opportunity for students to explore these terms and employ them in their work.

Key Competencies
Identify key competencies of particular relevance to this unit of work. Learning experiences should be developed to provide opportunity for students to use and enhance these competencies in their work.

Values
Identify values of particular relevance to this unit of work. Learning experiences should be developed to provide opportunity for students to explore and enhance these values in their work.

Cross Curriculum Links
Identify other curriculum areas of particular relevance to this unit of work. Opportunities should be made during learning experiences to facilitate these links.

Safety Issues
Note down any potential safety issues and how these can be addressed. The MoE Revised Health & Safety Guidelines will provide support in this area. Learning experiences developed should seek to address these safety issues and work to mitigate risks identified.

Approved by the University of Auckland Human Participants Ethics Committee on 2 Dec 2011 for 3 years
Reference Number 7712
Project Title: Food Literacy for the 21st Century
Researcher: Wendy Slatter

<table>
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<tr>
<th>Description of Context</th>
<th>Any Key Competency Learning Links?</th>
<th>Teacher Ongoing Annotations... What I noted about my lesson today/what I liked about my lesson today/What surprised me...</th>
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<tr>
<td>Class Description/Students Past Experiences?</td>
<td>Any Values being taught?</td>
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<tr>
<td>Key Focus of lessons – Links to any Curricula?</td>
<td>Key Focus – any Context specific skills or knowledge?</td>
<td>Any Cross Curriculum Links?</td>
</tr>
<tr>
<td>Any special terms needed to be taught?</td>
<td>Any special terms/skills needed to be taught?</td>
<td>Any Safety Issues?</td>
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</table>

Approved by the University of Auckland Human Participants Ethics Committee on 2 Dec 2011 for 3 years
Reference Number 7712
Please date and annotate within the squares in a different colour pen as your teaching progresses.

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<tr>
<th>PREDETERMINED SPECIFIC LEARNING OUTCOMES</th>
<th>ASSESSMENT CRITERIA</th>
<th>ASSESSMENT STRATEGIES</th>
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<th>NEGOTIATED SPECIFIC LEARNING OUTCOMES</th>
<th>ASSESSMENT CRITERIA</th>
<th>ASSESSMENT STRATEGIES</th>
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<thead>
<tr>
<th>LEARNING EXPERIENCES (Broken into Session Blocks)</th>
<th>LEARNING INTENTIONS</th>
<th>RESOURCES</th>
<th>LINK TO LEARNING OUTCOMES</th>
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Approved by the University of Auckland Human Participants Ethics Committee on 2 Dec 2011 for 3 years
Reference Number 7712
Project Title: Food Literacy for the 21st Century

Researcher: Wendy Slatter

TECHNOLOGY UNIT PLANNER EXPLANATION OF TABLE ENTRIES

Resources required
Identify human and physical resources that will be required in this unit and note these alongside learning experiences to ensure they are available as appropriate.

Predetermined Specific Learning Outcomes
Specific Learning Outcomes – both curriculum and context driven should be noted here. These should be clear statements of what you expect the student to know or be able to do.

Negotiated Specific Learning Outcomes
Class, group or individual student specific learning outcomes should be noted here. At the planning stage of the unit this will be blank. However, as the unit progresses and opportunities for negotiated learning outcomes arise, this section can be completed to ensure additional learning experiences are developed and incorporated into the delivery to support the class, group of students or individual students as appropriate.

Assessment Criteria
Statements to be used for making judgements on student achievement in relation to the specific learning outcomes. These should be used both formatively (to enhance learning during the unit delivery) and summatively (to make judgements on student achievement at the end of the unit). For curriculum driven learning outcomes these can be levelled as per the Indicators of Progression relevant to each component.

Assessment Strategies
Possible strategies for gathering information on students in terms of the specific learning outcomes – strategies should support both formative and summative assessment purposes and will be matched with learning experiences focused on the learning outcome as they occur throughout the unit.

Learning Experiences
This provides opportunity for recording an overview of the planned learning experiences (including teacher interactions) that students will be provided with throughout the unit. In developing these experiences teachers should take guidance from the Learning Environment indicators in the Indicators of Progression. The experiences should be developed to ensure that opportunity is provided to allow students to meet the predetermined specific learning outcomes and links to key competencies, values and other curriculum knowledge and/or skills should be made as appropriate. Strategies to gather assessment data for different learning outcomes can also be included in appropriate places throughout the unit.

Learning Intentions
These indicate the specific learning intention or key purpose of the learning experience. These may relate to one or more learning outcomes, the key competencies, values or other curriculum knowledge and/or skills.

Resources
Use this column to ensure required resources are sourced and available as needed.

Link to Learning Outcome/s
Clear links should be made to show how the block of learning experiences relate to the predetermined learning outcomes of the unit.

Approved by the University of Auckland Human Participants Ethics Committee on 2 Dec 2011 for 3 years
Reference Number 771
Appendix E Phase One Questionnaire 1 Likert in the Delphi Sequence

<table>
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<tr>
<th>Components of a food literacy education programme</th>
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<tr>
<td>How essential do you think the following components are in a food literacy education programme?</td>
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<tr>
<td><strong>1. How essential do you think the following components are in a food literacy education programme?</strong></td>
</tr>
<tr>
<td>Not at all essential</td>
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<tr>
<td>Food preparation from scratch</td>
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<tr>
<td>Innovation with food</td>
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<tr>
<td>Self-motivation, curiosity and confidence</td>
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</tbody>
</table>

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<th>2. Do you have any comments about:</th>
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</thead>
<tbody>
<tr>
<td>Food preparation from scratch</td>
</tr>
<tr>
<td>Innovation with food</td>
</tr>
<tr>
<td>Self-motivation, curiosity and confidence</td>
</tr>
</tbody>
</table>

| **3. How essential do you think the following components are in a food literacy education programme?** |
| Not at all essential | Not particularly essential | Slightly essential | Quite essential | Absolutely essential |
| Knowledge of the cultural dimension and significance of food |  |  |  |  |
| Knowledge of the systems that underpin food |  |  |  |  |
| Knowledge of scientific interactions in food |  |  |  |  |
| Knowledge of health-giving properties of food |  |  |  |  |

<table>
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<th>4. Do you have any comments about:</th>
</tr>
</thead>
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<tr>
<td>Knowledge of the cultural dimension and significance of food</td>
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<tr>
<td>Knowledge of the systems that underpin food</td>
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<tr>
<td>Knowledge of scientific interactions in food</td>
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<tr>
<td>Knowledge of health-giving properties of food</td>
</tr>
</tbody>
</table>

| **5. How essential do you think the following components are in a food literacy education programme?** |
| Not at all essential | Not particularly essential | Slightly essential | Quite essential | Absolutely essential |
| Knowledge of the origins of food |  |  |  |  |
| Knowledge of food-based career opportunities |  |  |  |  |
| Critical thinking and decision-making about food |  |  |  |  |
Application of financial knowledge to food purchasing decisions.

6. Do you have any comments about:
   Knowledge of the origins of food.
   Knowledge of food-based career opportunities.
   Critical thinking and decision-making about food.
   Application of financial knowledge to food purchasing decisions.

7. How essential do you think the following components are in a food literacy education programme?
   Not at all essential | Not particularly essential | Slightly essential | Quite essential | Absolutely essential
   Food hygiene.
   Skills of innovation, experimentation and development of food.
   Menu planning and food purchasing decisions.

8. Do you have any comments about:
   Food hygiene.
   Skills of innovation, experimentation and development of food.
   Menu planning and food purchasing decisions.

9. How essential do you think the following components are in a food literacy education programme?
   Not at all essential | Not particularly essential | Slightly essential | Quite essential | Absolutely essential
   Sensory experience of food.
   Application of cookery skills.
   Use of literacy and numeracy skills.

10. Do you have any comments about:
    Sensory experience of food.
    Application of cookery skills.
    Use of literacy and numeracy skills.
Appendix F Phase One Questionnaire 2 Likert in the Delphi sequence

Essential Components of a Food Literacy Education Programme

The food literacy education programme components outlined below are based on all the experts’ responses to the previous questionnaire. I have also presented a selection of respondent’s comments about the components that may support you in making your response this time round.

Please rate how much you agree that the components are absolutely essential, and also comment on why you gave the rating you did.

1. Food hygiene:
   - Is a component of food safety – and affects us all.
   - Essential from home to career – this should underpin all practical lessons.
   - This is one of the most critical areas in food; and is important to know about for the preparation of safe food.

To what extent do you agree that this component is absolutely essential in a food literacy education programme:

- [ ] Strongly Disagree
- [ ] Disagree
- [ ] Neutral
- [ ] Agree
- [ ] Strongly Agree

Why did you give this component the rating you did?


2. Application of Cookery Skills:
   - These skills are necessary for basic food preparation.
   - Practice makes perfect but this is also role modelling for the rest of the family to see.
   - Students should be able to apply one skill in different applications.

To what extent do you agree that this component is absolutely essential in a food literacy education programme:

- [ ] Strongly Disagree
- [ ] Disagree
- [ ] Neutral
- [ ] Agree
- [ ] Strongly Agree

Why did you give this component the rating you did?


3. Food Preparation from Scratch
   - Students need to be able to make meals from scratch as it reduces cost, fat, sugar and salt content of food.
   - Everyone should have a basic knowledge of how to prepare at least some food.
   - Food preparation from scratch is very important as this shows you what each ingredient does and can help you understand ingredients better.

To what extent do you agree that this component is absolutely essential in a food literacy education programme:

- [ ] Strongly Disagree
- [ ] Disagree
- [ ] Neutral
- [ ] Agree
- [ ] Strongly Agree

Why did you give this component the rating you did?


4. Self Motivation, Curiosity & Confidence
   - People need to feel confident to get cooking, and motivation is required to avoid laziness (the takeaway trap).
   - This aspect would enable innovation with food.
   - Students have to want to know more about food and therefore this aspect is absolutely essential to enable this.

To what extent do you agree that this component is absolutely essential in a food literacy education programme:

- [ ] Strongly Disagree
- [ ] Disagree
- [ ] Neutral
- [ ] Agree
- [ ] Strongly Agree

Why did you give this component the rating you did?


5. Menu planning and food purchasing decisions.
   * Essential basic skills families need to learn to enable them to live within their budget.
   * Vital for management of health and budgets.
   * So important because everyone purchases food and few make menus or plans about it.

   To what extent do you agree that this component is absolutely essential in a food literacy education programme:

   [ ] Strongly Disagree  [ ] Disagree  [ ] Neutral  [ ] Agree  [ ] Strongly Agree

   Why did you give this component the rating you did?


6. Use of literacy and numeracy skills.
   * Important for food purchasing and reading food labels.
   * Necessary to interpret recipes.
   * Necessary to understand the application of skills to food.

   To what extent do you agree that this component is absolutely essential in a food literacy education programme:

   [ ] Strongly Disagree  [ ] Disagree  [ ] Neutral  [ ] Agree  [ ] Strongly Agree

   Why did you give this component the rating you did?


7. Critical thinking and decision making about food.
   * With the increased manufacturing of food, this is important to ensure the healthiest option is chosen for the family.
   * Essential for people to be able to make the right choices about food.
   * This allows for innovation and product development of food products.

   To what extent do you agree that this component is absolutely essential in a food literacy education programme:

   [ ] Strongly Disagree  [ ] Disagree  [ ] Neutral  [ ] Agree  [ ] Strongly Agree

   Why did you give this component the rating you did?


8. Sensory experience of food.
   * Food is both a nutritional and a sensory experience.
   * Crucial to establish a taste for healthy foods at a younger age.
   * Necessary to know as much as possible about ingredients and flavours.
To what extent do you agree that this component is absolutely essential in a food literacy education programme:

- Strongly Disagree
- Disagree
- Neutral
- Agree
- Strongly Agree

Why did you give this component the rating you did?

   - This knowledge is influential in establishing and maintaining healthy eating patterns.
   - These principals of building a healthy lifestyle are very important.
   - This is essential given the lamentable health problems we have in NZ which is probably based on ignorance of the practicalities of managing one’s own food intake.

To what extent do you agree that this component is absolutely essential in a food literacy education programme:

- Strongly Disagree
- Disagree
- Neutral
- Agree
- Strongly Agree

Why did you give this component the rating you did?

10. Application of financial knowledge to food purchasing decisions.
    - Money is everything when it comes to food purchasing, as well as product development in industry.
    - This is an important skill to help people choose the cheapest food with the healthiest nutrition profile.
    - If learnt at an early age it may be easier for them to budget for food as adults with families.

To what extent do you agree that this component is absolutely essential in a food literacy education programme:

- Strongly Disagree
- Disagree
- Neutral
- Agree
- Strongly Agree

Why did you give this component the rating you did?

11. Knowledge of the systems that underpin food.
    NOTE OF EXPLANATION:
    For the purposes of this research the term ‘systems’ refers to the systems that underpin the food – distribution, production and growing, advertising, processing overviews, preservation, additives, tolerances, marketing, food labels, and packaging.

    - These systems are influential in identifying, establishing and maintaining healthy eating.
    - Students need to understand and know what is involved here with their food before they eat it.
    - There could be no food literacy without the inclusion of these aspects to the food chain being involved.

To what extent do you agree that this component is absolutely essential in a food literacy education programme:

- Strongly Disagree
- Disagree
- Neutral
- Agree
- Strongly Agree
Why did you give this component the rating you did?

12. Knowledge of cultural dimension and significance of food.
   * Essential for all New Zealanders particularly around Maori cultural aspects.
   * Without this dimension food would exist in a vacuum, this gives it a sense of purpose.
   * People need to know that there is more to food than just eating it.

To what extent do you agree that this component is absolutely essential in a food literacy education programme:

- [ ] Strongly Disagree
- [ ] Disagree
- [ ] Neutral
- [ ] Agree
- [ ] Strongly Agree

Why did you give this component the rating you did?

Thank you for taking the time to further consider these elements of a food literacy education programme.
## Appendix G List of Participant Information Sheets and Consent Forms used within project

<table>
<thead>
<tr>
<th>Phase</th>
<th>Participant Information Sheets and Consent Forms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase One</td>
<td>PIS/CF Food Experts</td>
</tr>
<tr>
<td>Phase Two</td>
<td>PIS/CF Focus Group</td>
</tr>
<tr>
<td>Phase Three</td>
<td>PIS/CF Principals*</td>
</tr>
<tr>
<td></td>
<td>PIS/CF Intervention Teachers*</td>
</tr>
<tr>
<td></td>
<td>PIS/CF Parents*</td>
</tr>
<tr>
<td></td>
<td>PIS/AF Students</td>
</tr>
</tbody>
</table>

* indicates PIS documented in Appendix I.
## Appendix H Coding rules for Expert Interview Data

<table>
<thead>
<tr>
<th>Code</th>
<th>Theme</th>
<th>Sub-Theme</th>
<th>Coding Rule</th>
</tr>
</thead>
<tbody>
<tr>
<td>D-A</td>
<td>Disposition</td>
<td>Authentic</td>
<td>Appreciation of the authentic in the preparation of food, e.g., meals for a real family</td>
</tr>
<tr>
<td>D-I</td>
<td>Disposition</td>
<td>Innovative</td>
<td>An ability to be innovative and try new things, e.g., try a new food, work without a recipe.</td>
</tr>
<tr>
<td>D-M</td>
<td>Disposition</td>
<td>Motivation</td>
<td>Personal confidence and self reliance, e.g., try to prepare food</td>
</tr>
<tr>
<td>D-C</td>
<td>Disposition</td>
<td>Compulsory</td>
<td>Food education should be for everyone, from an early age</td>
</tr>
<tr>
<td>K-C</td>
<td>Knowledge</td>
<td>Culture</td>
<td>Rituals and practices of particular groups in society, ability to recognise food has importance/cultural dimension and significance</td>
</tr>
<tr>
<td>K-S</td>
<td>Knowledge</td>
<td>Food Systems</td>
<td>Systems that underpin our food – growing, distribution, retail, additives, processing, food labels</td>
</tr>
<tr>
<td>K-I</td>
<td>Knowledge</td>
<td>Ingredients</td>
<td>Science of our food</td>
</tr>
<tr>
<td>K-N</td>
<td>Knowledge</td>
<td>Nutrition</td>
<td>Study of health-giving properties of our food</td>
</tr>
<tr>
<td>K-O</td>
<td>Knowledge</td>
<td>Origins</td>
<td>Where our food comes from</td>
</tr>
<tr>
<td>S-CT</td>
<td>Skills</td>
<td>Critical Thinking</td>
<td>Ability to think wider and deeper about food and act on that knowledge</td>
</tr>
<tr>
<td>S-F</td>
<td>Skills</td>
<td>Financial</td>
<td>Application of money to food, budgeting</td>
</tr>
<tr>
<td>S-H</td>
<td>Skills</td>
<td>Hygiene</td>
<td>Application of food hygiene rules and guidelines</td>
</tr>
<tr>
<td>S-I</td>
<td>Skills</td>
<td>Innovation</td>
<td>Apply innovative ideas to the production of food to produce a new food item</td>
</tr>
<tr>
<td>S-S</td>
<td>Skills</td>
<td>Shopping</td>
<td>Practice and application of shopping skills to the purchasing decisions about food</td>
</tr>
<tr>
<td>S-T</td>
<td>Skills</td>
<td>Tasting</td>
<td>Experiencing food in a sensory way, knowing how foods should tase</td>
</tr>
<tr>
<td>S-C</td>
<td>Skills</td>
<td>Cooking</td>
<td>Application of cookery skills to food</td>
</tr>
<tr>
<td>S-L</td>
<td>Skills</td>
<td>Learning</td>
<td>In possession of basic numeracy and literacy skills</td>
</tr>
<tr>
<td>F</td>
<td>Food as a Career</td>
<td>Food as a Career</td>
<td>Knowledge of or ideas about the career pathways in the food area</td>
</tr>
</tbody>
</table>

*Note: The table above lists the coding rules for expert interview data, categorizing observations into themes and sub-themes.*
Appendix I Selection of Participant Information Sheets and Consent Forms used within project

School of Science, Mathematics and Technology
The Faculty of Education
University of Auckland
74 Epsom Avenue
Auckland
Ph: 09 623 8899 ext 48439

Participant Information Sheet

Principals

Project Title: Food Literacy for the 21st Century

Researcher: Wendy Slatter

Researcher Introduction

My name is Wendy Slatter. I am a doctoral student at the University of Auckland, Faculty of Education. I have been until recently also the Head of Food Technology at Epsom Girls Grammar School. The focus of my research is to find out how we could educate students about food in order to equip them for 21st Century life. This letter introduces the third phase of this research. The first stage involved asking experts about the essential components of food literacy. This process provided ten essential components of food literacy. The second phase of this research will provide information from teachers about the practicalities of teaching such components from a proposed planning model. This third phase will involve a small group of teachers planning and teaching a unit of work that contains some of these components. This will occur in term 1 of 2012, and is designed to answer the following research question.

How is a food literacy teaching model interpreted and actioned in a foods education classroom?

Project Description and Invitation

I have contacted you as the principal of a school where a teacher from phase two has expressed an interest to me in being involved in this third phase of the project. This teacher (XXXXXXX) is a teacher of food education of year 9 or 10. I ask for access to your school so that I can ask this teacher formally and request permission to ask her students for access to photocopy their pre and post work data.

Project Procedure

The project will involve your teacher providing a unit plan and taking part in three interviews (approximately one hour each) where she will be discussing her planning of this unit of work and its implementation. These three interviews will provide information about the planning, implementation and the learning that has occurred and would occur at a mutually agreeable time and location. The interview will be audio taped and she will have control of this activity by being able to refuse to answer questions and/or turning off the tape at any time.
In addition I would like to access information about students’ learning from a generic pre and post work, ideas of which are included for your information. I would like to photocopy this pre and post work and would be asking students to agree to this. An information sheet and consent form will be provided for students and their parents and only those who agree will have their work included in the study. In order to protect the identity of participating students the teacher will agree to photocopy all pre and post work (one page in each case) and I ask, in order to keep confidentiality the school administration assistant will identify, sort and provide to the researcher only those students pre and post work for which she has permission.

I include copies of all of these participant information sheets, work ideas, interviews schedules, and consent forms for your perusal.

I request your assurance this teacher’s participation or non participation will not affect their employment status and standing in the school, and that student participation or non/participation will not affect their school interactions.

Data Storage/Retention/Destruction/Future Use

It is intended that the interviews will be audio-taped will be transcribed by an external transcriber who has signed a confidentiality agreement. This information will be kept confidential. All consent forms, data and recordings of the interviews will be held in separate secure storage and destroyed after six years by document destruction services.

The photocopied pre and post work will be anonymised and will be held in a separate secure storage and destroyed after six years by document destruction services. Those photocopied pre and post work that are not eligible will be destroyed immediately.

Right to Withdraw

I recognise that you can refuse access to the school at any time and that there may be conditions that prevent you from allowing the process to be completed. You have the right to withdraw your permission at any time without explanation up to 30 March 2012. The teacher will be given an opportunity to edit their interviews and withdraw their data up to 2 weeks after this editing process is completed. Students will not be given an opportunity to withdraw their pre and post work.

Confidentiality

The identity of the school will be disguised and the teacher will be given a pseudonym. Students’ work will be coded and their names will be removed. Consent forms and the corresponding codes will be held in a separate locked filing cabinet in my supervisor’s office. Careful attention will be paid to ensuring that the school cannot be identified in the interview statements, teacher planning sheets or any public presentations or reports. However, it must be recognised that ideas and phrases might be attributable to the teacher, as the foods education community is a small one in New Zealand.
Future use of this information

As well as providing research information for my doctorate, it is anticipated that papers will be presented at conferences and published in journal articles. A summary of this research will be provided to you and the teacher.

Contact Details

My contact details as project researcher are listed below. If you have any further questions about the research please contact the people indicated below. Please note you are under no obligation to participate in this research project.

Yours sincerely

Wendy Slatter

School of Maths Science and Technology

Faculty of Education

The University of Auckland

wslatter@auckland.ac.nz

Ph 021 795 366

My project supervisor:
Dr Bev France
Associate Professor
School of Maths Science and Technology
Faculty of Education
The University of Auckland
Ph 09 623 8899 ext 48439
b.france@auckland.ac.nz

Head of the School of Maths, Science and Technology
Dr Gregor Lomas
Faculty of Education
The University of Auckland
ph 09 623 8899 ext 48517
g.lomas@auckland.ac.nz

For any queries regarding ethical concerns you may contact:
The Chair
The University of Auckland
Human Participants Ethics Committee
The University of Auckland
Office of the Vice Chancellor
Private Bag 92019
Auckland 1142
Ph 09 373-7599 ext 83711.

Approved by the University of Auckland Human Participants Ethics Committee on 2 Dec 2011 for 3 years Reference Number 7712
Participant Information Sheet

Teacher

Project Title: Food Literacy for the 21st Century

Researcher: Wendy Slatter

Dear

Researcher Introduction

My name is Wendy Slatter. I am a doctoral student at the University of Auckland, Faculty of Education and have been until recently the Head of Food Technology at Epsom Girls Grammar School. The focus of my research is to find out how we should educate students about food in order to equip them for 21st Century life. This letter introduces the third phase of this research. The first stage involved asking experts about the essential components of food literacy. This process provided ten essential components of food literacy. As you are aware the second phase of this research asked you about practicalities of teaching such components. This third stage requires a teacher to plan and teach a unit of work that contains some of these components and you have indicated in phase two that you are interested in taking part in this final phase.

Project Description and Invitation

I invite you to participate in this phase of the research. This would involve planning and teaching a unit of work that incorporates some of these essential components of food education. I would require you to be interviewed three times for about an hour at each session when you would talk provide a plan and background your reasoning, comment on the progress of the unit in the second interview and reflect on the implementation and learning in the third. I have an assurance from your principal that your participation or non-participation will not affect your employment status or standing in the school.

In addition I request student data information about their learning from a generic pre and post work that is included for your information. Because these year 9 or 10 students are under 16 years, their parental permission would be required. There will be an information sheet and consent form provided for the parents and students in your class, and I ask you to distribute
them to the class. Those who choose to take part will be able to return them to the school office via an addressed envelope.

**Project Procedure**

Your voluntary participation would involve being interviewed three times for about an hour at a mutually agreeable time and place. As the research is based on your planning and teaching of this unit I ask for a unit plan and any annotations about it implementation that you may care to include as you work through your teaching programme.

In addition I would like to access information about students’ learning from a generic pre and post work that is included for your information. In order to protect the identity of those students who have consented to take part I ask you to photocopy all of these work and pass them to the school office administrator. I will only use those whose permission I have obtained. All student data will be anonymised.

I include copies of relevant information sheets, work ideas, interview schedules and consent forms for your perusal.

I believe that your involvement will make an important contribution to future directions of food education. I appreciate such a time commitment and will provide you a small koha of appreciation in form of a $50 Westfield voucher at the conclusion of the interviews as well as a synopsis of the findings.

**Data Storage/Retention/Destruction/Future Use**

It is intended that the interviews will be audio-taped and be transcribed by an external transcriber who has signed a confidentiality agreement. All information will be kept confidential. All consent forms, data and recordings of the interviews will be held in separate secure storage and destroyed after six years by document destruction services.

**Right to Withdraw**

I recognise that your participation is voluntary. You have the right to withdraw your participation at any time throughout the research process (before, during, after) without explanation and withdraw any data identifiable to you up until March 30 2012. During the interviews may be questions you do not wish to answer and you have the opportunity to refuse to answer the questions by offering a ‘pass’ response and turning of the audio recorder. You will be able to review and edit the interview transcripts for a period of two weeks after they have been provided to you.

**Confidentiality**

Your identity will be disguised by the use of a pseudonym provided at the commencement of the interviews. Careful attention will be paid to disguising your personal, collegial details so you cannot be identified in the interview statements, teacher planning sheets or any public presentations or reports. However, it must be recognised that ideas and phrases might be attributable to you, as the foods education community is a small one in New Zealand.
Future use of this information

As well as providing research information for my doctorate, it is anticipated that papers will be presented at conferences and published in journal articles. A summary of this research will be provided to you.

Contact Details

My contact details as project researcher are listed below. If you have any further questions about the research please contact the people indicated below. Please note you are under no obligation to participate in this research project.

Yours sincerely

Wendy Slatter

School of Maths Science and Technology

Faculty of Education

The University of Auckland

nsla005@aucklanduni.ac.nz

Ph 021 795 366

My project supervisor:
Dr Bev France
Associate Professor
School of Maths Science and Technology
Faculty of Education
The University of Auckland
Ph 09 623 8899 ext 48439
b.france@auckland.ac.nz

Head of the School of Maths, Science and Technology
Dr Gregor Lomas
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For any queries regarding ethical concerns you may contact:
The Chair
The University of Auckland
Human Participants Ethics Committee
The University of Auckland Office of the Vice Chancellor
Private Bag 92019
Auckland 1142
Ph 09 373-7599 ext 83711.

Approved by the University of Auckland Human Participants Ethics Committee on 2 Dec 2011 for 3 years
Reference Number 7712
Participant Information Sheet

Parents and/or caregivers

Project Title: Food Literacy for the 21st Century

Researcher: Wendy Slatter

Researcher Introduction

My name is Wendy Slatter. I am a doctoral student at the University of Auckland, Faculty of Education and have been until recently the Head of Food Technology at Epsom Girls Grammar School. The focus of my research is to find out how we should educate students about food in order to equip them for 21st Century life. Part of this research involves me working alongside some teachers who will be planning and teaching some programmes that implement these ideas.

Project Description and Invitation

This research will occur at your child’s school during term 1 2012 and will involve the foods teacher planning and teaching a unit of work that is designed to enhance students understanding of food for your child’s class. I invite your child to participate in my research project. They will take part in a normal programme and be required to hand in a pre and post work ideas that will be given to everyone in the class. These two pieces of work will provide information about what has been learned in this teaching programme.

If you agree and your child agrees, the following procedure will occur. Your signed consent forms will be returned to a drop box in the school office and will be collected after being sorted by the school administration assistant to the researcher. They will then be kept safe in a locked filing cabinet separate from the data that is collected. The teacher will collect all the pre and post work and photocopy them. These photocopies will be sorted by the school administration assistant and then given to the researcher and she will use only those who have given permission, and the rest will be destroyed.

All names on the work will be removed and replaced with a code so your child’s identity will be disguised. This material is very precious and will be kept in a locked filing cabinet for 6 years after which it will be destroyed by a firm specialising in document destruction.

Please be assured that your child’s participation or non-participation will not affect their learning as this programme will be occurring for everyone in the class and the teacher will not know who has consented to take part. The principal has agreed that your child’s participation or
non-participation will not affect their standing or subsequent assessment. However, to protect your child’s anonymity it is not possible to withdraw this assessment material once it has been submitted.

Please discuss this information with your child and if you agree that your child can take part please sign the following consent form. Because your child is under 16 they are required to give their assent as well.

**Contact Details**

My contact details as project researcher are listed below. If you have any further questions about the research please contact the people indicated below. Please note you are under no obligation for your child to participate in this research project.

Yours sincerely

*Wendy Slatter*

School of Maths Science and Technology, Faculty of Education

The University of Auckland

nsla005@aucklanduni.ac.nz

Ph 021 795 366

My project supervisor:  
Dr Bev France  
Associate Professor  
School of Maths Science and Technology  
Faculty of Education  
The University of Auckland  
Ph 09 623 8899 ext 48439  
b.france@auckland.ac.nz

Head of the School of Maths, Science and Technology  
Dr Gregor Lomas  
Faculty of Education  
The University of Auckland  
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Office of the Vice Chancellor  
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Auckland 1142  
Ph 09 373-7599 ext 83711.

Approved by the University of Auckland Human Participants Ethics Committee on 2 Dec 2011 for 3 years  
Reference Number 7712
Appendix J Helen’s coat stand diagram
Appendix K Helen’s unit plan and task documentation
<table>
<thead>
<tr>
<th>Negotiated Specific Learning Outcomes</th>
<th>Assessment Criteria</th>
<th>Assessment Strategies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Two meals and recipes for those meals are developed.</td>
<td>Conversation with teacher about suitability. Attendance at practicals. Recipe pages completed for meals planned.</td>
<td>Ongoing formative comments. Photos. Recipe page marked/calculative comments given.</td>
</tr>
</tbody>
</table>

Please date and annotate within the squares in a different colour pen as your teaching progresses.

<table>
<thead>
<tr>
<th>LEARNING EXPERIENCES (Broken into Lesson Blocks)</th>
<th>LEARNING INTENTIONS</th>
<th>RESOURCES</th>
<th>LINK TO LEARNING OUTCOMES</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>By the end of the lesson the students will:</td>
<td>• Brief worksheet. • Glue. • Workbooks.</td>
<td>Students will be able to write a brief with identified needs and opportunities and key attributes.</td>
</tr>
<tr>
<td>15 mins</td>
<td>* Identify from their given brief a need or opportunity and key attributes.</td>
<td>Success Criteria: identify key attributes of a randomly selected object (e.g., roasted peanuts)</td>
<td></td>
</tr>
<tr>
<td>10 mins</td>
<td>10 mins</td>
<td>10 mins</td>
<td></td>
</tr>
<tr>
<td>Preceded delivery</td>
<td><strong>Definitions of need and opportunity copied</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Definition of 'needs' and opportunities:</td>
<td>* A need in technology refers to an identified requirement of a person or group; if it is identified from an issue; we undertake tech practice to meet an identified need.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• An opportunity refers to an identified possibility for a person or group; the opportunity is identified from an issue.</td>
<td>Scenario given. Given brief analysed. Brainstorm definitions of sections in a brief (not really done), particularly needs/opportunities and key attributes.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15 mins</td>
<td>Write key attributes of roasted peanuts</td>
<td>* Hand out a few peanuts to each student; ask them to write down everything they can about their peanuts.</td>
<td></td>
</tr>
<tr>
<td>• Teacher to have 2 lists on board – 'physical' and 'functional'</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Reflection (27.03.2012):
* Forgot to put up L.T.
* Some good comments when the scenario was handed out when they saw they only had $20.00 – eg. ‘... there'll be something in the cupboard...’ ‘I'll raid the pantry’
* When I tried to talk about what they might be doing on the Saturday, very few said they'd actually be doing sport; most said they'd be sitting at home playing games.
* Did some work in the needs that arose from the scenario – we will probably need to re-visit this.

<p>| 2                                               | By the end of the lesson the students will: | Nutrition pamphlets • Text books | Students will be able to use prepared food models (Nutritional Guidelines for Teenagers, Food Pyramid, Four Food |
| Nutritional needs:                               | * Work co-operatively to create an |                           | Food) |</p>
<table>
<thead>
<tr>
<th>10 mins</th>
<th>Put class into 3 random groups (mention them off this would produce 3 groups of 5). (Based on the quality of work done in the previous unit I have selected 3 leaders); each leader will take it in turns to select a team member; alternating males/females; each group is allocated either “food groups”, “serving sizes” nutritional needs of teenagers or “food pyramid”. Groups will have 1½ hour to produce an A2 poster that will be displayed on the wall; they will have access to appropriate information.</th>
</tr>
</thead>
<tbody>
<tr>
<td>30 mins</td>
<td>A2 poster depicting either food groups, serving sizes or the food pyramid. Success Criteria: The poster and self-evaluation will be finished and have been started.</td>
</tr>
<tr>
<td></td>
<td>Magazines</td>
</tr>
<tr>
<td></td>
<td>Glue</td>
</tr>
<tr>
<td></td>
<td>Scissors</td>
</tr>
<tr>
<td></td>
<td>A3 sheets selotaped together</td>
</tr>
<tr>
<td></td>
<td>Groups and apply the guidance within these to a given situation/brief.</td>
</tr>
</tbody>
</table>

Feedback 27 March Personally I would need to give random groups a job each, like a summariser of the information [récrire-kahilika], a reader-kahinakamaoto, a writer to type up and glue on the summarised info, an artist to plan the layout, a cutter-upper of magazines [utilisée manager/kahilika thera raavua], a presenter of the poster to the class [rapporter kahilika]. A note taker (kabatihaleka) – and give them an expectation of time you know, 5 minutes planning, 15 minutes doing your job, 15 minutes back together with your task done to put on the page (or whatever) just to make sure it was a focused ½ hour and presentable at the end. And this links to your key competencies... |

Reflection (28-03-2012):  
- The way I set up the groups sort of worked – the groups led by the 2 girls produced a very satisfying amount of focused work; posters of food pyramid and 4 food groups have been started – I’m actually really buzzing about the success of this lesson – I feel I’ve finally had a good attempt at trying co-operative learning  
- The boys group – complete contrast; what a low point; one boy spent whole time generating the heading while the rest of the group just sat ...and sat. They didn’t engage with their topic – ££  
- It’s a realisation I should have given them the food pyramid to do; another strategy could have been to talk with them about (?? Something to hook them in – SEWP? The All Blacks?) and bring it back to (eg) when SEWP was a teenager what would he have needed nutritionally?  

Reflection (29-03-2012):  
- NCC and VFS think this concept could be more difficult for year 10’s to grasp and have suggested that the 2nd poster be to identify the 6 nutrients – food sources and function: 1 person/nutrient  
- In this way, the 3 posters can be used as the basis for the web-based research lesson, with the information from all 3 posters linking into the nutritional requirements for teenagers.  

<table>
<thead>
<tr>
<th>2</th>
<th>Nutritional needs: Nutritional needs of teenagers vs. other population groups. How to write on a food plan sheet.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>What nutrients do we know about/her about in the media?</td>
</tr>
<tr>
<td></td>
<td>What are the 5 major population groups?</td>
</tr>
<tr>
<td></td>
<td>Using appropriate text books, plot the NNR for each nutrient (including energy) against different population groups</td>
</tr>
<tr>
<td></td>
<td>Fill in food plan sheet with what the student ate yesterday; analyse the sheet for any gaps; identify what needs to be added; what it is...</td>
</tr>
</tbody>
</table>

By the end of the lesson the students will:  
- Complete a food plan sheet with recommended intakes for a teenager.  
Success Criteria: Food plan sheet will be completed  
- Text books  
- Graph paper  
- Coloured pencils  
- Food plan sheet  

Students will be able to calculate the serving sizes based on needs of a teenager. |

Helens final unit plan

---

3 Practical: Macaroni Cheese  
- 1-2 students will be allocated the making of the packet macaroni cheese  
- Students have an hedonic chart to fill in which compares the homemade maca cheese with packet version.  

By the end of the lesson the students will:  
- Have made macaroni cheese.  
- Have tasted a packet macaroni cheese.  
- Made notes: have completed an hedonic scale; comments comparing and contrasting the two macaroni cheeses.  

Students will be developing some decision-making skills to the shopping and purchasing of food items for their planned menu items.  
Food Literacy Component: Menu planning and food purchasing decisions. (Message of the day: the taste of food will affect the foods appeal to people, this will affect food purchasing decisions).  

Helens final unit plan
Recap and Finishing off:
- Evaluation of the 2 maca-cheeses using sentence starters:
  On Thursday 29th March I made macaroni cheese. The purpose of
  making this product was so I could compare it with a packet version
  of maca-cheese. I wanted to find out what product was preferred by
  people in my class. The chart below shows how I got my
  information:

<table>
<thead>
<tr>
<th>Home-made maca-cheese</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Taste</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| Packet maca-cheese     |      |      |      |      |      |
| Taste                  | 1    | 2    | 3    | 4    | 5    |

By the end of the lesson the students will:
- Know which type of macaroni cheese is preferred by the class

- Powerpoint
- Cushings
- Dye colour chart

Helen's final unit plan

Another way to research food: Nutritional Panels
What is it?
How do you read them?
What's an ok level for teenagers when compared with expert opinion
- Weighing portion sizes to serving sizes and panel information
- Labelling as an introduction
- Interactive yoghurt ANSFA poster, data show in room

Went to two lessons

By the end of the lesson the students will:

Students will be developing some
decision-making strategies to the
shopping and purchasing of food items
for their planned menu items.

Food Literacy Component: Menu
planning and food purchasing decisions.
(Message of the day: accessing
information about food from the packets
will affect the foods appeal to people.
This will affect food purchasing
decisions).

7 Shopping:
Where and how do people in the class do their shopping,
influences in supermarkets to make you buy - heights of food on
shelves, music, food demos, big signs on the end of rows...

By the end of the lesson the students will:

Monica Fry
"Technology at
the supermarket"

Students will be developing an
awareness of the role of the shop on
their decision-making strategies to the
shopping and purchasing of food items.

Food Literacy Component: Menu
planning and food purchasing decisions.
(Message of the day: the shopping
environment influences you making
purchasing decisions).

Approved by the University of Auckland Human Participants Ethics Committee on 2 Dec 2011 for 3 years Reference Number 7772

Approved and verified 12 April 2012

Helen's final unit plan
Scenario...

Your parents have been called up north to see your aunty but you have something planned for Saturday afternoon and can’t go with them. After much persuading your parents have allowed you and 1 trustworthy friend to stay home alone. They will leave you with $20.00 to cover your meals from Friday night to Sunday. If your budget allows, you would like to plan a special dinner for when your parents return on Sunday. This will show them how trustworthy and capable you are.

Group Challenge

Your group will have ½ hour to produce an A2 poster that can be displayed on the wall of the classroom.

The topic of your poster is:
Nutritional needs of Teenagers
- You can only use the resources in this room (including the computers) to gather your information.

The people in your group are:
1. Tom
2. 
3. 
4. 
5. 
6. 
7. 

Each person in your group should have a different job:

<table>
<thead>
<tr>
<th>Kaipanui (Reader of Information)</th>
<th>Kaipatai (Questioner)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kaituhituhi (Recorder of Information)</td>
<td>Kaituhiti Korero (Report information back to class)</td>
</tr>
<tr>
<td>Kaipirihinima (Noise controller)</td>
<td>Kairwhakahaere rauemi (Materials manager – you will plan the layout of your poster)</td>
</tr>
</tbody>
</table>

You will have 5 minutes in your group to plan the task.
15 minutes carrying out your research
15 minutes to assemble your poster

You will present your poster to the rest of the class at another lesson.
Appendix L Helen’s student work exemplars
Appendix M Samy’s PCKgft mechanism model

Knowledge of Pedagogy
School educational goals
There is a clear difference between Year 9 and 10. Because in year 9 our school only gives them a short amount of time with them. i283
Probably all of year 10 should focus on literacy. e15

Unit planning, curriculum links and examination systems
Our intentions are too big. We always try and put too much in. e1

Classroom practice of teacher
The teaching that happened here (between micro-biology and preservation techniques) helped them make the connections. e98
I do the pair-observation. Split the class and say ‘you observe...’ e182
[suggesting alternate assessment like pamphlets, questions] I can see depth, depth to their understanding far greater than in a test. Do. Apply their knowledge. e205
Language is hard. I spend a lot of time of literacy. e38
I actually wanted them to practice using the information and linking it. Like teach them personal hygiene, but until you get to link in with the working with the food, then they make the connection, e47
Group work i52.
There is a lot of peer support happening in my room. i124
I don’t know how it all works. I write my units, but then all those other things just kind of happen. I have planned it in my head. I don’t just go, oh today I’m going to do, positive feedback... i160
To me it’s important that I bring all I have taught, together. A conclusion and you can then reflect on that together. o80
I watch them cook. e85

Knowledge of Subject Matter
Teaching of technology knowledge
They don’t see [technology] as generic. e24
We try really hard to get them to make connections. If we learn a brief over here, they’re still talking about a brief over here. e25

Teaching of food hygiene skills
I would have expected cross-contamination. e232
It’s all about the application of food hygiene rules and guidelines. e249
The safety. OSH, physical, when I say food safety it isn’t just bacteria. i53
I use teacher knowledge as a resource o53.
Person hygiene. e49

Teaching of preservation and micro-biology
You have to understand what you are actually trying to do them [the food products and teaching preservation techniques]. e263
If you increase the sugar levels, you’re changing something about the way that bacteria multiply. e56
You change the food, altering conditions, whether it be the warmth, the moisture, the food content by acid, sugar, salt...
We’ve also looked at the good bacteria and the bad bacteria [bread and ginger beer]. e69

Knowledge of Wider Environmental Contexts
Wider contexts influencing teaching
I have students who went off to work [seasonal fruit picking] for a term, sometimes they come back again, sometimes not. i210

Diversity
Some of my students will not get a job [disabled]. But they develop life skills from being in my class, that they will use for the rest of their lives. i233
I had a senior boy with a severe learning disability and the other boys were just great. i126

Knowledge of Students
Learning strategies
If they can just do it at their pace, I’m not rushing them e203
I hope to instill an interest i28
I want them to pick it up [the knowledge] and do it, e86
I think the real-ness of food is how to teach this. Real food. Not pictures. o127
I want them to learn the application of food hygiene – get them to actually practice using the information. e47.

Abilities and developmental levels
My boy who is dyslexic. i200
You have to move them past the “Me, Me.” Teach about being responsible, for yourself, being responsible for your learning, your environment. i97
They often need help with literacy aspects. i112

Prior conceptions of subject/motivation
The kids I have got are really keen on doing FOOD. e498
Food can be a great motivator. I mean, they are always hungry. i40

Knowledge of her students
The majority of my students like the hands-on. i111

Key: i = initial interview o = ongoing interview e = exit interview Highlighted text shown in Ch 6.
Appendix N Pippins PCKgf mechanism model

Knowledge of Pedagogy
School educational goals

Key:
i = initial interview  o = ongoing interview  e = exit interview  Highlighted text shown in Ch 6.
References


