Learning food technology outside the classroom: A study of a secondary class visit to a live historical village

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Abstract

This thesis explores food technology learning experiences outside the classroom. The participants in this study were year 11 students who had selected food technology as one of their NCEA subjects. A living historical village, near to the students' school, was chosen as the site for an interactive learning experience. The era and artefacts represented by this village are associated with 19th century New Zealand.

The purposes of this study were to determine to what extent an interactive learning experience through a live historical village helped students learn about food and the technologies used to produce food; and whether this experience helped students better understand the complex relationship between food technologies and society.

The study was informed by research literature on technology education in general and food technology in particular, as well as literature examining student engagement with history and learning outside the classroom.

The study adopted a qualitative, interpretative methodology and data was gathered from surveys, tests, classroom activities, document analysis and a focus group interview.

The study's findings clearly indicated that the trip to The Historical Village helped the students learn about the constituents of food products and the technologies used to produce food. The historical context of the village engaged the students and enabled them to associate developments in food technologies with changes in society.

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Chapter 1 Introduction

Learning food technology outside the classroom: A study of a secondary class visit to a live historical village

Food technology students are accustomed to learning and developing their skills with food, during practical lessons inside the classroom. As the title suggests this thesis explores student learning in food technology in a different context. The participants in this study were year 11 students who had chosen food technology as a subject to study towards their National Certificate in Educational Achievement (NCEA) level one. This study arose from the opportunity to combine a learning experience outside the classroom, to a historical village on a live day, with an achievement standard assessment task. The historical village, which is located near to the school, provided a stimulating environment for students to examine the development of food technology outcomes; and evaluate food technology practice as a purposeful human activity that impacts on the world (Compton & France, 2006).

In this first chapter of my thesis I discuss some topical issues that relate to food and then highlight the concerns of some writers regarding the place of food and cooking in society today. These contemporary views on the state of food knowledge influenced me into asking what do food technology students know about the food they eat. The next section of this chapter situates learning about food within the technology curriculum, and as a learning experience outside the classroom. The final part of this chapter provides a background to the historical village which was the site arranged for this food technology learning experience.

1.1 Food and cooking

One human need which constantly has to be satisfied is the provision of food. It plays a major role in meeting nutritional, social, emotional and spiritual needs. The social needs met by food are often more important than physiological needs (Reynolds, 1998).

Bawden's (1997) description of food is limited to its scientific attributes and relationship to health. She describes food as any substance, liquid or solid, which is consumed by the body to provide materials for growth, repair and maintenance of body tissue; heat and energy; regulation of body processes; and protection from

disease. Food comes from animals and plants; and manufactured food products. Processed food products are described as combinations of ingredients from different sources. It is the separate chemical components of food (nutrients) that have the potential, diverse functions that benefit health. Generally people agree that there is a relationship between the food we eat and our state of health.

The provision of food cannot be separated from cooking. Cooking can render foods non-toxic, edible, palatable, and more digestible, thereby increasing their energy value. Before cooking, food was eaten raw. Meat and many plant foods can be eaten raw but with applied heat the whole concept of food is transmuted (Derven, 1999).

Food is what matters most to most of the people most of the time. Felipe (2002) suggests its history is underappreciated and its study is neglected. For some it is about nutrition and health and for others it is essentially about cuisine. There is increasing interest now in how food nourishes societies as well as individual bodies; how it feeds, identifies and defines groups.

The evolution of human culture is directly connected to the way food is obtained. The logistics of agriculture and hunting have shaped notions of gender and community; food is often integral to concepts of the sacred in a society; and the loneliness of the fast food eater, aided by such inventions as the microwave, has become emblematic of contemporary society's fragmentation (Felipe, 2002).

The controlled use of fire was a critically important innovation in human evolution. It altered the landscape encouraging the growth of new vegetation, attracted game, and ultimately commenced farming practices. There was a universal connection between food and fire, attributed perhaps to the changes it created in the flavour and texture of different foods. The processes of obtaining food, building a fire, and cooking remained the same for centuries, passed from generation to generation. Radical shifts in technology over the last few hundred years have seen fire becoming enclosed and controlled as coal, coke, gas, and electricity were used for stoves. The direct and visible connection to the flame was disappearing and the hearth, the heart of the home, was slowly vanishing. Stoves became white, more modern and sanitary (Derven, 1999). Derven (1999) describes the invention of the microwave as a dramatic moment in history.

Cooking food without a direct heat source severs our connection with fire. While flame reappears fleetingly in barbecues, many people today have no experience of building a fire.

Many food writers are expressing concerns about the consequences of the industrialisation of food. In 1907 Escoffier, a French chef whose textbook defined French cuisine for seventy years, forecast the kind of cooking that would replace him. He predicted that cooking would become scientific and elaborate in formula. He believed the art of cooking depends on the psychological state of society, and it is not possible to separate the two. The art of cooking develops when life is relaxed and not troubled. It provides an agreeable pleasure. On the other hand where the thousand anxieties of industry and business consume a man's spirit, the need for nutrition is no longer a pleasure but a burden and the time spent at the dinner table is lost (Kurlansky, 2002).

Mallet (2004) laments the fate of food. The art of cooking is dying. Once it was the heart of the home and evoked a dense web of feeling but now the communal family meal has dissolved into individual eating units. A century ago enough food and good cooking was an unalloyed pleasure. It was not simply to be eaten. It was a living memory bank for what it represented; tastes, conversation, companionship, and friendships. We have gone from loving food to fearing food. We are frightened by food science and medicine and as a result old familiar recipes, the threads of the community, are being lost.

What should we have for dinner? The answer to this question has become complicated according to Pollan (2006). Native wisdom has been replaced by the confusion and anxiety of 'expert' nutritionists determining our dinner menu. Pollan interprets the changes in a nation's eating habits as a sign of disorder, and this would not happen in a culture in possession of deeply rooted traditions surrounding food. The pleasures of eating are deepened by knowing. The pleasures of eating industrially are fleeting.

We (our ancestors) have been eating milk, butter and beef for thousands of years (Planck, 2006). Planck (2006) describes traditional food as being under attack, from science and industry, and in need of defence, and that the conventional wisdom on traditional foods is mistaken. Planck attributes the diseases of

civilisation, obesity, diabetes, heart disease, and some cancers, to industrial foods. Diabetes is a global pandemic in the making. It is being accepted, normalised and managed with new industry foods, drugs and gadgets. It is easier and more profitable to change the disease of civilisation into a lifestyle than change the way that civilisation eats. A more ecological and cultural approach to reduce disease is to go backwards to the diet and lifestyle of our ancestors (Pollan, 2008).

It used to be: eat food, not too much and mainly plants. The thousands of edible substances in the supermarket are the novel products of food science, often with nutritional claims. Our culture/ our mothers have lost their authority over the dinner table. Help in deciding what to eat now comes from journalists, nutritionists, scientists, food marketers, the Government et al (Pollan, 2008).

How food is consumed – in the car, on the street, between appointments, at desks, in lectures etc is not really eating in the sense that civilisation has long understood the term. Historically food is about family, community and our relationship with the natural world. Both Planck (2006) and Pollan (2008) commend the revival of farmers' markets, organic foods and a renaissance of regional cooking and food traditions.

Schlosser (2002) asks what the all-American meal – fast food – is doing to the world. Fast food chains have changed what Americans eat and how food is made. Current methods for preparing fast foods are less likely to be found in cook books than in trade journals. Aside from a few salad greens and tomatoes most fast food is delivered to restaurants already frozen, canned, dehydrated, or freeze dried. Foods that may look familiar have been completely transformed. The end product is the result of a highly complex system of mass production.

Hundreds of millions of people buy fast food every day. They rarely consider where this food comes from, how it was made, and what it is doing to the community around them. As the old saying goes, you are what you eat. People need to know what lies behind every fast food transaction (Schlosser, 2002).

The well regarded chef Jamie Oliver expresses similar views regarding Britain's nutritional concerns, particularly obesity. Today there is plenty of food and unlimited choices and yet we are living in a world of junk food, additives and preservatives. Today people have little or no idea how to cook or what makes a

balanced diet. Oliver says that to combat obesity we need to learn from the past. We need to look back at the way our grandmothers and great-grandmothers cooked – wholesome, tasty food that was simple and quick to prepare (Oliver, 2008).

Despite a growing trend in New Zealand back towards home cooking and gardening, fast food outlets were among the few businesses to do well in the recent recession. Restaurant Brands New Zealand Ltd (KFC, Pizza Hut & Starbucks) is forecasting a further increase in profits for 2010 (Barnett, 2009). A 2009 survey of New Zealand schools identified junk food as a lunchtime staple (Barnett, 2009). Rising rates of obesity and diabetes are predicted outcomes. There are children who cannot identify vegetables and a decreasing number of people who know how to cook. The growing gap between consumers and their knowledge of food production is a factor in New Zealand having the highest incidence of reported campylobacter (a microbiological food poisoning organism) in the world (Stuart, 2009, as cited in Barnett, 2009). Stuart says life in the cities has distanced us from the place food is produced. This is a far cry from the way our predecessors dealt with food and it is important to avoid letting another generation grow up so disconnected from their food (Stuart, 2009, as cited in Barnett, 2009).

We all – growers, consumers, and cooks – need to know more about the food we eat, and what trends and technologies characterise the food supply. The role of food has changed. The meaning of cooking is changing. Our relationship with food is altered by innovatory food processing technologies and fast food. The food system has, in modern times, been characterised by technological change and sustained growth in productivity. However the introduction and diffusion of technological innovations is uneven. Not all societies accept genetically modified crops for example. Functional foods (claim to have health-promoting or disease-preventing properties) promise health benefits and are at the cutting edge of innovations in the food industry. Edible solutions to consumer health concerns are the opportunity to shift the food innovation focus towards prevention of food related disorders. Today the food supply is challenged by a combination of biotechnologies and external forces. An understanding of food and underlying issues around food will help people to respond to the fundamental challenges that

face us all (Millstone & Lang, 2008). Fallon and Enig (1999) prescribe a wise and loving marriage of modern invention with the nourishing traditions of our ancestors to transform the 21st century. Pollan (2008) says that it will be hard to go backwards to a diet and lifestyle of our ancestors without the cultural tools to guide us.

Food and cooking is an infinitely rich subject area. There are always some things new to understand better, fresh sources of interest, ideas and delights (McGee, 2004). Young people may think their food starts at the fast food outlet or grocery store; however given the opportunity they enjoy hearing about food stories and food history. Teaching children to cook may shape their eating habits for the future. Cooking skills last a lifetime and help children learn about nutrition and healthy eating. Children are enthusiastic about eating something they have made themselves. They learn real lessons in science, language, mathematics and creativity. They feel the importance of contributing and family. They practise planning, evaluating and making choices (Catherall, 2009).

1.1.1 Technology Curriculum Strand: The Nature of Technology

Technological literacy in The New Zealand Curriculum is structured around the three strands: technological practice; the nature of technology; and technological knowledge. While each strand contributes to the 'whole' of technological literacy it is the curriculum strand the nature of technology which focuses learning on the socially embedded nature of technology. This strand has two components: characteristics of technology; and characteristics of technological outcomes. Learning experiences in this strand provide students with an ability to develop critical understanding of technology as an intervening force in the world, and that technological developments are influenced by historical, social and cultural events (Compton & France 2006).

Component: Characteristics of Technology

This component recognises and values that what is designed is always positioned within a particular time, and physical and social location. Technological designs therefore are influenced by the natural world, culture, politics, and the dominant ideologies of the time. Technology in turn has a profound and complex influence on the social and natural world. This socio-technological perspective recognises

and brings together both the determinist perspective – technology determines social change; and the social shaping perspective – society determines technological change. Creative and critical thinking are important to technologists. Reflecting on technologies encourages technologists to push boundaries, learn from the past, and project into future possibilities (Compton & France, 2006).

Component: Characteristics of Technological Outcomes

This component acknowledges that technological outcomes have a physical and a functional nature. Understanding the relationship between the physical and functional nature of technology outcomes is crucial to a student's own technological practice and for understanding technological outcomes generally. A product's fitness for purpose is interpreted through what the product looks like and is comprised of; what the product can do; and can only be fully understood when the social and historical context of the product's development and use are known. Past and contemporary influences on product development can provide possible insights into future implications and subsequent adaptations or innovations (Compton & France, 2006).

1.2 The Nature of Technology in a Foods Context

At school food activities within food technology are carried out in a variety of broad, overlapping contexts such as personal life, the home, the school, recreation, the environment and industry. A foods programme connects conspicuously with students' everyday lives as well as the world beyond the school gate. Students critique the impacts of food technology innovations and developments on societies and the environment; they explore how food developments and outcomes are valued by different peoples in different times; and students are increasingly able to engage with current and historical issues relating to food, including exploring future scenarios (Ministry of Education (MOE), 2005 & 2007).

Learning experiences focused on the nature of technology strand and its components offer students the opportunities to develop philosophical understandings essential for a broad and critical literacy (Compton & France, 2006). A story of food events in a historical setting provides a rich context for discussion and debate. Students have the opportunity to examine systems of food

production, preparation, and consumption, including associated artefacts, in a new context. They identify the contributions of their forbears/ancestors. Food technologies until recently have gone unrecognised as technology despite their fundamental concern with problem-solving in response to societal need. Students begin to understand and challenge the values and institutions that have brought this about (Burns, 1997).

The expression of food production in a different time and place serves two important functions. The social contexts of the development of food technologies are removed from those which we accept as the norm in our society so students are better able to recognise them. Greater understanding of their own relationship with technology is achieved. Such a study allows students to identify the people and institutions that have been involved in these developments, the knowledges and techniques that have been used, and the values that have been supported and dismissed (Burns, 1997).

1.3 Technology Curriculum: Learning Outside the Classroom

Encouragement to take children outside the classroom for their learning is signalled in Technology in the New Zealand Curriculum. A link between schools and the community is important to a well developed inclusive technology curriculum. Outside experiences enhance, reinforce, and clarify classroom learning. Students benefit from input from the specialist mentoring role from experts within the community. There is ready access to relevant resources. Enjoyment of the experience has a positive impact on students' participation and sense of belonging which increases their confidence to participate in new contexts. It is through the exploration of technology within a specific community that students gain an appreciation of the reciprocal relationships between technology and society. They see how and why decisions were made (MOE, 1995).

The curriculum suggests that where students experience the 'real' world of food technology they are equipped to make choices that enhance well being and health. They see and experience the knowledge and skills relating to food processing, and the handling of equipment and materials. As well as from contemporary groups, teachers are encouraged to look to the past for opportunities when developing

tasks and activities that will engage their students. When researching and analysing the past students see how technologies used to be used and appreciate the impacts of earlier technologies on the environment and decision making. Students are challenged to understand how cultural factors, values, social structures, economics, and location, availability of natural resources, and environmental considerations, influence decisions taken (MOE, 1995).

Students' interest in food technology could be stimulated through a visit to a live historical village where the food technological contributions of a past society, belonging to a specified historical period, are displayed, used and maintained. Such a visit would provide an opportunity for food technology to be explored, undertaken and evaluated in relation to a specific cultural context. Recognition would be afforded to the values, beliefs and needs of that community of practice and students would see the interrelationships between that society and the food technologies they utilised (Burns, 1997). Through a carefully planned approach to an outside classroom experience, to a neighbourhood live historical village, students will be able to articulate their ideas about issues relating to food and cooking technologies in New Zealand while meeting many of the challenges inherent within the New Zealand Curriculum.

1.4 The Historical Village

The village is located within a few kilometres of the College concerned with this study. It is situated on a seven acre site of gardens and buildings representative of a Fencible settlement during the 1840 to 1880 period. There are over thirty original colonial buildings collected from the district and relocated onto the site, including schools, a church, forge, and general store (Historical Village, 2010).

The aim of the Village Education Department is to depict life in 19th century New Zealand through hands on and interactive programmes related to the period 1840 to 1880. The village describes its programmes as away from the classroom, unique and very relevant to the national social studies and technology curricula (Historical Village, 2010).

Volunteers are highly valued people at the village. They are a team of people who work together to carry out the many tasks that need to be done to keep the village going. They work in a public role, in period costume and behind the scenes

working with children in the education team, looking after gardens, working with archives and photographs, repairing and restoring historical artefacts, working at a variety of crafts, and being part of live days (Historical Village, 2010)

During a village experience students with a food technology context students make lemonade from lemons, churn cream into butter, cook biscuits or fritters over an open fire, and bake bread in a wood fired range. They compare the gadgets of yesteryear with modern technology and admire the dining room set ready for an evening meal (Historical Village, 2010).

The Fencibles

The Royal New Zealand Fencible corps were retired soldiers from Britain and Ireland, often referred to as Pensioners, who enlisted as a military reserve to act as a defence force for the protection of the early settlers in the fledgling town of Auckland, New Zealand. The men had served in many regiments of the British Army in many parts of the world. They were used to harsh conditions and many were pensioned out as being unfit for further active service, largely due to rheumatism. There were over 2,500 men, women and children who arrived in New Zealand during the years 1847 - 1852. They settled in the now south and eastern suburbs of Auckland. In return for availability in case of attack, and attendance at parades, the Fencibles were to be provided with a cottage and an acre of land, which after seven years service they would own (The New Zealand Fencible Society Incorporated, 2010).

A large number of the families were from Ireland, which was in the middle of the famine period, and all would have been leaving for a better life in New Zealand. The promise of owning land would have been a great incentive. When the first contingent arrived it had not been decided where they should settle. The cottages were not built. The families quickly settled into life in New Zealand, building their own houses, growing vegetables and finding work on neighbouring farms (The New Zealand Fencible Society Incorporated, 2010).

The Fencibles swelled Auckland's population at the time. They created the four villages now suburbs of Auckland. These villages are now bustling communities. The Fencibles came for a better life. They committed themselves to developing their communities with their labour and their limited resources. They were

instrumental in the creation of roads, bridges and lines of communication. They shaped their communities with churches, schools, shops and local governing bodies. Without their service Auckland would have been a very different place to what it is today (The New Zealand Fencible Society Incorporated, 2010).

By naming the 'school houses' after high profile Fencible soldiers, the College at the centre of this study continually acknowledges the Fencibles' contribution to the community.

Food and Cooking in the Historical Village

It took several months for emigrant sailing ships to reach New Zealand from Britain. Many ships carried milch cows and started out with livestock such as pigs and poultry which were eaten when required. This fresh food would last until half way and then the emigrants would be 'on hard tack' for the remainder of their long voyage. The Fencibles cooked their food in a tiny galley with provisions supplied by ship, consisting of salt beef and pork, preserved fish, flour, rice, ship's biscuits, oatmeal, dried carrots, potatoes, dried peas, cheeses, butter, raisins, sugar, mustard, pepper, pickles, tea and coffee (Blake, 1983).

Journey's end for the Fencible families was to be in improvised sheds placed above the beach, where they waited patiently for their houses to be built. They arrived just before Christmas 1847. Blake (1983) speculates: "One can imagine the … beach on the first Christmas of the first Summer with the smell of food barbecuing … on the gridiron, breadmaking in the camp ovens with cakes made on the … griddle, and meat or cockles in the pots" (p. 32).

Fish could be caught in abundance from around the cliffs and cockles were easy to obtain in the shallow seabed. With these, vegetables, fruit, kumara and potatoes could be bought from the Maoris who had quickly adapted their natural gardening techniques to include the European vegetables and fruit introduced by the very early settlers of the 1830's. These earlier settlers already farming in the area supplied milk and butter (Blake, 1983).

The first temporary dwellings after the beach were raupo whares. The Fencibles lived in these while their promised permanent houses were being built. Cooking was done in the open. There was always a risk of whares catching fire. During

1848 and 1849 the weatherboard houses were built. They were built with fireplaces designed for use with wood as the fuel. Pots and a kettle hung on chains from hooks inside the chimney. The heat of the utensils was regulated by raising or lowering them on the chains. Bread was cooked in the camp oven, cakes and damper were made on the griddle, and meat was broiled over the open fire on the gridiron. Water was obtained from brick lined wells or collected from the roof (Blake, 1983).

The kitchen was small and the families were large so much of the cooking was done outside when the weather was fine. A fire enclosed with a ring of stones and protected by a wind break of manuka would be used. Vegetables such as potatoes, cabbages, leeks and turnips would be grown, as well as herbs including balm, mint, parsley, sage, thyme and horseradish, to give flavour to food and for medicinal purposes. Some Fencibles had stock – great and small cattle. Most had egg laying and eating fowl, and game birds as well as ducks for their eggs. Pork, brought by the Maoris, was a delicacy for the Fencibles (Blake, 1983).

Fencibles grew wheat which was ground into flour for cooking and making bread. The bran was used as poultry food. Wheat farms and flour mills developed within a few years. When the settlers worked away from home or went on picnics they took damper with them. This was an unleavened bread mixture of flour, water, sugar and butter which was cooked in hot ashes. A gypsy pot would be placed in the fire for cooking stews, meat, shellfish, potatoes or hash and a billy would be suspended above the pot brewing tea. Eggs were often fried on a shovel (Blake, 1983).

On arrival in New Zealand the Fencible families were expecting houses and cooking facilities similar to what they had left behind in their homelands. The promised houses were not ready and in fact were not started when they arrived. Families began life in New Zealand cooking over open fires on the beach. They experienced communal living in a shed, life in a tent, and then a raupo hut before finally acquiring their own weatherboard house with fireplace. Over a two year period the Fencibles experienced the range of cooking techniques developed over centuries. The historical village which replicates this period eclipses a short period of time in the lives of this group of people, but a long period of time in terms of the development of food technologies. Visiting the village provides a unique

opportunity for students to glimpse significant events in the history of food and cooking. This window on the past is a rich context for food technology students to learn about food and technological developments; to appreciate that technological developments are influenced by historical and cultural events; and to develop a critical understanding of technology as an intervening force in the world.

The discussions in this chapter established the background and context for the visit to The Historical Village. The research questions evolved from this discussion and they were:

- What are the benefits of taking secondary school food technology students on an interactive learning experience through a live historical village?
- How does this experience help students understand the development of food technologies?
- How does this experience help students appreciate the complex interface between food technologies and society?

In the next chapter I discuss relevant literature that was reviewed for this study. The chapters following the literature review describe the research methodology; outline the research findings; and discuss those findings in light of the literature.

Chapter 2 Literature Review

This study is informed by a literature review that covers four main areas, each of which is discussed separately in this chapter. Each area is defined and then described in relation to education and the curricula. The context for this study is food technology.

2.1 Technology

2.1.1 Essential Features of Technology

Throughout history human beings, seeking to shape their environment, engaged in technology. They developed artefacts to meet basic needs of food and shelter, maintain health, and provide care for themselves and their families. The history of technology attests to peoples' needs to transform their environment. It is the character of these transformations that has changed a great deal over time. From the simple tool in the bare hands of a naked ape two and a half million years ago, to the computers and space shuttles of today. "... and just think of what we have in between! A prodigious wealth of technological knowledge, artefacts, components, and systems created over thousands of years, all over the world!" (Ginner, 2007)

Technological development from a historical perspective has been and is about the extension of human physical and mental skills and capabilities. This expansion of technology is discerned in the transformation of natural elements for instance stone into axe, fish bone into needle, iron ore into steel; the development of storage techniques such as refrigerators and computers; transport systems like the donkey, space shuttle, and internet; as well as many regulating and controlling technologies including lasers, fire alarms and sensors (Ginner, 2007).

Merely thinking of the artefact is a restricted meaning of technology. Bush (1983) says that describing technology requires greater clarity. The terms tool, technique, and technology have often been used interchangeably; when in fact they describe related but distinguishable phenomena. A tool is a member of a class of objects: gadgets, machines, appliances, and instruments such as hammers, spoons, and washing machines. The techniques are the skills, methods, procedures and processes that people perform in order to use tools for instance carpentry, baking,

and laundering. Technology then refers to the organised system of interactions that utilise tools and involve techniques for the performance of tasks and the accomplishment of objectives. The tools and techniques of some household tasks for example are hammers and carpentry; spoons and baking; and washing machines and laundering (Bush 1983).

There are other aspects to technology practice. Bush (1983) defines technology as a form of cultural activity that applies the principles of science and mechanics to the solution of problems. Technology includes the resources, tools, processes, personnel, and systems developed to perform tasks and create immediate particular, and personal and/or competitive advantages in a given ecological, economic, and social context (as cited in Bush 1983).

Kline (1985) refines Bush's (1983) attributes of technology. His description of technology comprises four components:

1. the artefact itself – a non natural object manufactured by humans
2. a system of manufacture – all the elements needed to manufacture the artefact including inputs, people, machinery, resources, processes as well as regard for the legal, economic, political, and physical environment
3. the technique/know how/methodology – the information, skills, processes and procedures for accomplishing the task making the artefact
4. a system of use that gives purpose to the manufacture of the artefact – a system utilising the artefact, the people and other resources. Humans cannot accomplish the tasks unaided by such systems (as cited in Layton, 1993 & Fleming, 1989).

Technology makes better sense when it is attached to the context with which it is meant to be a part. It is more than a product, it includes the process by which technological products are developed and used and the people involved in using the products. Technological design and context are closely integrated. Putting men on the moon was a major feat of modern technology. Considerably more than machinery was involved. The extra ingredients were the goal to get a man on the moon by the end of the sixties; a defined series of practical tasks such as building rockets and sending people into orbit; and utilising skilled people with specialist knowledge such as scientists, engineers, and technicians. None of these people

could have achieved the task individually therefore a social organisation was necessary. The success of the space programme was the result of complex interactions between people and social structures in the one hand and machines in the other (Naughton, 1994).

There is too a cultural aspect to technology practice. A technological artefact is imbued with values, beliefs and creative activity. Medical practice is not only technical, but also has an ethical and organisational element to it and the same is true of technology practice (Layton, 1993).

Adams (1993) says that for most of the history of the earth there was not technology because there were not humans. Human beings are at the centre of every technological development. Their survival has depended on acquiring the tools and developing the techniques for organising their environment – farming, building, and transforming raw materials; constrained by the availability of resources; but enhanced by expertise and skill built up from years of experience (Appleton & Ilkkaracan, 1994).

Knowledge and skill are the foundation of technological developments. Over the last 200 years the development of technology has been linked to the formal research procedures associated with scientific enquiry (Maybury, 1982, as cited in Appleton & Ilkkaracan, 1994). Historians, philosophers and sociologists too have all contributed from their unique perspectives to enhance our understanding of technology. Converting scientific achievements into marketable and value added products draws upon scientific, technological, economic, environmental and legal knowledge in order to develop the techniques, methods and designs that work in certain ways and with certain consequences (Layton, 1993).

Hence technology is defined very broadly. The range of technologies available today is broad, as is the range of potential problems that technology might solve. The creation of new technologies and extension of old technologies can only increase the ranges of both (Wonacott, 2001).

2.1.2 Technology and society

Technology causes change in the physical world; it changes the very society in which it operates. Technological literacy is concerned with understanding this relationship between technology and social change. The power and versatility of

technology are key to economic prosperity. Technology brings many benefits to society such as improved healthcare, communications, clothing, housing and so on. New technologies can however cause social strain. They become politically and socially interesting. People are encouraged to examine technology critically; its potential benefits, costs, and the political and social forces driving its development (Fleming, 1989; Layton, 1993).

Technology has changed a great deal. The extent of change has not been anticipated. There was a time when technologies developed primarily to serve human needs (Adams, 1993). Basalla (1988) says that the growth of modern large technical systems in manufacturing, power production, transportation, and communication, overwhelm human values and defy human control. The way people live, work and play is structured by the technological order that governs modern society. People look to technology for the solution to many of society's problems while having reservations about the downside. Society needs to spend more effort understanding technology and become better at managing it (Adams, 1993).

The approach to technology needs to be rethought says Pool (1997). Air and water pollution, hazardous wastes, ozone layer depletion, and global warming are some of the higher than expected long term costs of technology. Creations that make the world a richer, healthier and more comfortable place also cause concerns. People worry about the sort of world they are leaving to their children.

The approaches to the design of new technologies for industry were to focus on their physical functions and trust that the human operators were adaptable. The accepted measures of machinery were how fast they are, how much they can produce, the quality of their output, how easy they are to use, how much they cost, and how long they last. An improvement in technology meant an improvement in one or more of those measures which were assumed to be important to the consumer. In the early days of a new technology producers and manufacturers generally have more pressing things to think about than inherent safety (Pool, 1997). In the light of lessons learned from serious accidents which occurred in the chemical and nuclear industries Pool (1997) suggests that building safety standards into new technologies from their inception may alert ahead of time technologies that could cause hazards in the future. Genetic engineering is

described as one such threat. Pool (1997) says that if technology continues to change as it has, growing in power and complexity; and if society continues to demand less risk for technology, there may come a time when safety considerations predominate in the development of technology.

Domestic technologies

Electric lights, running water, washing machines, electric ranges, and vacuum cleaners were promoted as technologies that would eliminate drudgery, save labour time, and increase leisure. Kline (2003) suggests that is not necessarily the case. Kline (2003) refers to time-use surveys undertaken by sociologists and home economists over a 40 year period who found that newer household technologies reduced energy but did not correlate to less time spent on housework. Time remained constant. The research showed that the use of artefacts such as the coal range, water pump, and vacuum cleaner tended to reduce the workload of the helpers, such as husbands and children, and to promote higher standards of housework.

The introduction of domestic technologies resulted in major social changes. Wajcman (1991) considers that the reallocation of household labour, particularly reducing the amount of time men engage with housework, is a consequence of household technologies that women tend to manage exclusively such as waste disposal units and dishwashers. Other influences resulting in social changes include a rise in standards of personal and household cleanliness; spending more time and effort in parenting; and housework being seen as a representation of the housewife's affection for her family. Wajcman (1991) also says that these societal trends, which accompanied the development of domestic technologies, were exploited and further promoted by advertisers in their drive to expand the market for domestic technologies.

The history and social shaping of domestic technologies lie in the merging of public and private worlds. Domestic technologies were not specifically designed for household use. They could be considered transfers from industry. Typically new technologies are at first too expensive for applications to household activities. They are employed on a large scale by industry until continued innovation and economies of scale allow reductions in cost and adaptations to household

circumstances. Many domestic technologies were initially developed for commerce, industry, and defence. Later, as manufacturers sought to expand their markets they were adapted for home use. Electric ranges were used in naval and commercial ships before they were introduced to the domestic market. Microwave ovens are a direct descendent of military radar technology and were developed for food preparation in submarines. They were introduced to airlines, institutions and commercial premises before manufacturers turned their eyes to the domestic market. Not until the costs of manufacturing techniques came down were domestic technologies able to be sold at a reasonable cost (Wajcman, 1991).

Wajcman (1991) perceives a gendered meaning encoded in the design process of the objects and artefacts adapted for the home. Domestic objects were presented as attractive, high-tech, discreet, and with smooth workings covered from view. The user and location in the home were also specified. This representation furthered the prevailing ideologies of hygiene and housework.

The design and development of technical artefacts should be treated as if technology and society constitute a seamless web (Bijker, 1992). Pacey (2001) asks what would technology would look like if it had been consistently developed by individuals whose outlook was people centred. People centred technologies are seen in the ergonomic design of chairs for example; seat belts in automobiles; and the safety of food and drugs. Pacey (2001) says this people centred approach is limited as it is not much concerned with human relationships or personal values.

The term technology applies only marginally when thinking about practical activities in the home says Pacey (2001). The art of cooking is a central example of how technique and skill ought to be related to human needs. Cooking along with other domestic technology is sometimes described as home economics. The use of the word economics may reflect an unconscious desire to think more in terms of the processes of providing for a family or serving the needs of a community. The essence of a people centred approach lies in the relationship between the technologist and the people who use or benefit from the processes or techniques the technologist develops. Pacey (2001) suggests that a redefinition of technology may be desirable to encompass a people centred approach.

A rounded view of technology calls for attention to three objectives: to produce necessary and useful goods and services; to enable people to use and develop their abilities and skills, and other qualities as people; and to provide the means for individuals to collaborate and cooperate with one another. For example nurses sees beyond the physiological horizon to the human experience. They cannot take a simple object centred view of the human body if they are to feel empathy with their patients and care for them well (Pacey, 2001).

A traditional example of technology arising from dialogue between the user and the maker can be seen in Hargreaves spinning jenny invented 1764. The jenny enabled spinners to keep pace with increasing demand while still working in their homes (Pacey, 2001). The process of the invention originated from within the social context where it would be used. It was socially shaped and also influenced society by giving rise to further significant advances (Bijker, 1992) in textile technology.

Conventionally scientists and engineers are assumed to be outside the systems they work in. Discoveries such as Hargreave's jenny come from within the system. Home economics focuses on science originating within the situation where it is to be used. Done in this spirit, discoveries, learning and inventions in home centred science arise from feedback within the system. There are no arbitrary boundaries between science and life (Pacey, 2001).

2.1.3 Technology and Education

The essential features of technology are reflected in the definition of technology described in the New Zealand Curriculum (2007): "... intervention by design: the use of practical and human resources to develop products and systems (technological outcomes) that expand possibilities by addressing needs and realising opportunities" (p. 32). The aim being for students to achieve technological literacy through undertaking technological practice developing a range of outcomes; generating knowledge particular to their enterprise; while appreciating the socially embedded nature of technological outcomes (MOE, 2007).

The three strands of the curriculum – technological knowledge, technological practice and the nature of technology interrelate. Technological practice involves

using knowledge and understanding and takes into account issues impacting on society (Jones, 1997).

Technology education is a learning area that deals with the ways in which human beings change their environment to fit better with their needs and wants. Students have the opportunity to learn processes and techniques through manipulating materials and tools. Knowledge is derived from many and varied sources including science, arts and heritage. Technology education adopts a more generalised approach than the former technical and craft subject areas of resistant materials, technical drawing and home economics (de Vries, 2009). Theory and practice, historically separated in technical education, are integrated in technology education.

The goal of technology education is for students to experience the all encompassing human activity of problem solving. Academic instruction put to work in an applied way develops critical thinking skills better than in a typical academic classroom. Students situated in the context of a need might appreciate the work of craft workers and the skills required for their work. They see how systems work together (de Vries, 2009).

Integrating knowledge, understanding, capability, and the interrelationship between technology and society enhances students' and ultimately society's technological literacy. Students contribute to and learn to critique technological developments from an informed perspective (The Institution of Professional Engineers New Zealand Inc (IPENZ), 2001- July).

Developing technological literacy is important for the technological society in which we live today. It is important for students to learn to read and write, use numbers, and use and control technological devices and systems. Users of technology also need to understand the human and social aspects of technology. Every technological problem is a socio-technological problem. Technology education offers learners an introduction to technology as a component of both a professional life and life as a consumer and citizen (de Vries, 2009).

Initiatives in education have long lasting effects. A way forward for New Zealand is to build up the wealth-creating sector. The basis of a wealth-creating sector is having and utilizing knowledge in a unique way to create or fill market needs.

Knowledge is derived from many sources such as art, science, technology and engineering but makes sense delivered through technology. Such an education has the potential to drive innovation, entrepreneurship and business skills required of the wealth-creating sector. Technology education fosters attitudes that underpin innovation, entrepreneurship and business skills whilst developing in students a view balancing the importance of community, and social and environmental aspirations (IPENZ, 2001 - May). We need people who can look at situations in an innovative way, develop new material, a new process, a new device, or a better way of doing what we are currently doing. The New Zealand food industry is an industry that is a major generator of wealth because of the many crops, foods and processes developed here. Achievements in the food industry increase the diversity, convenience and desirability of foods New Zealanders purchase and export (Hassell, 2009).

Through learning good technological practice within an area such as food technology, students work creatively and analytically to identify, trial and evaluate potential solutions. Students gain not only specialised skills and knowledge within the foods area but also the generic skills of showing initiative, being innovative and creative, learning independently, taking responsibility, teamwork and communication, as well as contributing to the community socially and environmentally.

Understanding the nature of technology is critical to students developing sound attitudes towards technology. A contemporary view of technology education addresses intellectual challenges inherent within technological artefacts, systems and environments. It explores the contribution of knowledge and initiative, and human choice in identifying, evaluating and finding solutions to societal problems (Burns, 1992).

2.1.4 Implications for teaching and learning in technology

It is important for students to utilise a range of processes when developing their technological literacy and capability. It is part of their developing a broad concept of the nature of technology. Representing technology adequately to students needs to give the clear message that theory and thinking in technology cannot be separated from technological activity. All students have preferred learning styles,

and utilising a range of processes when teaching technology will appeal to more students than would the use of a single process. It also makes the teaching of technology more interesting (Williams, 2000).

Artefact

Students generally have positive attitudes towards technology but some students still perceive technology as exclusively artefacts (Burns, 1997) for instance computers. An important component of technology education is practical activity and the technical considerations associated with making things. Students exhibit high levels of engagement designing, making and presenting outcomes, for instance in food or materials. They manage materials and tools skilfully and safely (MOE, 1995; MOE, 2007). However successful artefacts are embedded with organisational endeavour such as planning and use. There are too cultural aspects – the values, beliefs and creativity with which an artefact is imbued (Layton, 1993).

In spite of the range of specified contexts suggested for technology education, focusing on the artefact has allowed the technological areas to be interpreted as discrete subjects rather than technology as one holistic subject based on broad ranging contexts and technological areas. A technologically literate student appreciates the major part that design and technical skill play in the development of an outcome but also explores and develops the contribution of tacit knowledge and initiative thought (Burns, 1997).

Knowledge

Knowledge arises from a range of sources as students are involved in observing, examining, and experiencing applications of technology. Students acquire knowledge of material properties, constituent parts of systems, how and why things operate, codes of practice such as food safety in food processing, strategies used for the communication, promotion and evaluation of ideas, and how technologists work (MOE 1995, 2007). Students will identify different types of knowledge in a subject as diverse as technology.

Identifying, using and evaluating knowledge are at the heart of technological innovation and enterprise. It is too important to leave to chance (Twiss, 1992).

Students need to get the clear message that theory and thinking in technology cannot be separated from technological activity. The grounds for introducing new knowledge in technology are its usefulness in progressing towards completion of the task (Williams, 2000). Knowledge acquires substance as it is linked to the problem it helps to solve. As knowledge of process and content is integrated students acquire conceptual understanding and the focus is on thinking and relationships (Berieter, 1992; McCormick, 1997).

2.1.5 Adapting learning theories to take account of technology

Critical thinking

It is in knowledge rich domains that strong interactions between structures of knowledge and cognitive processes emerge (Glaser, 1993). A technologically literate student is not merely a consumer of today's distractions but has learned to think critically. The student has engaged in the active process of pursuing relevant and reliable knowledge about the problem under investigation, reflected on what needs to be done, and assessed any impacts of the technology. Thinking leads to reliable, trustworthy outcomes (Schafersman, 1991).

In addressing the community's need to compete in a global economy it is crucial for education to include critical thinking skills (Schafersman, 1991). Students need to be introduced to a wide range of problem solving techniques that can be brought to bear on the problems they encounter. These habits are transferable when life situations are used as the content (Glaser, 1993).

Constructivism

Educators widely endorse the idea that students construct rather than simply acquire knowledge. Constructivism is a transition from the traditional idea of knowledge acquisition where knowledge is transmitted from teacher to student, to one where the focus is on concept development and deep understanding. Technology education offers persistent, high level problems around which a sophisticated body of knowledge can be constructed (Berieter, 1992).

Knowledge integration occurs when the student is engaged in learning for which the student themselves is responsible. They acquire knowledge when activities are centred on practical problems that have to do with interpreting and interacting

with the world outside the classroom. Personal goals, past knowledge and experiences, and interactions with peers and experts shape the students' learning as new information and understandings are assimilated (Berieter, 1992). This constructivist's view poses challenges for technology education. What can be assumed about a student's existing prior knowledge, ideas and concepts when faced with a new task in technology? New concepts require time for ideas to be developed (McCormick, 1997).

Situated cognition

Learning is most successful when embedded in authentic and meaningful activity making deliberate use of the physical and social context (Hennessy, 1993). Too often the practices of contemporary schooling deny students the chance to engage in relevant domain culture. People who use tools actively build a rich, implicit understanding of the world in which they use the tools and of the tools themselves. Learning how to use the tools frames the ways in which the learners see the world and understand the culture in which the tool is used. To learn to use tools as practitioners use them a student, like an apprentice, must enter the community and its culture (Brown, Collins, Duguid, 1989). Students process and remember while located in a real world of everyday activity, and social interactions, and a historical development of ongoing activity. Learners are surrounded by the characteristics of such schooling, like an apprenticeship. They are empowered to continue independently (Lave, 1991).

The situated nature of knowledge in technology, observing and living within a particular culture, fosters particular thinking dispositions. Through engaging collaboratively, observing closely, looking at and reflecting upon other points of view, and being alert to shifting contexts students behave as practitioners and develop conceptual understanding. Harder to define factors such as motivations, sensitivities, values and the like also figure prominently in good thinking (Perkins, 1993).

A goal of situated learning is to establish an interesting, realistic context that fosters active construction of knowledge in the learner. Learners reflect on new knowledge and understanding that is developed during the problem solving process. Students experience the value of exploring the same setting from multiple

perspectives – historian; scientist. New information functions as tools to shape perception and comprehension rather than as mere facts to be memorised. A further goal is for new knowledge acquired in one situation to be applied in another. Situated learning is more conducive to this transference because it relies upon real-life settings and facilitates transfer more efficiently than the more formal contexts associated with institutionalised learning (The Cognition and Technology Group at Vanderbilt, 1990).

2.1.6 Responsibilities of technology education

Students in a world of socio-technology

Education must concern itself with past, present and future. Traditionally technology courses have focused on techniques but in the real world much is developed whose desirability might be open to question. Educators want to develop young people who are adequately prepared to understand and control technology rather than be controlled by technology. Critical reflection upon and appraisal of technology must include its fitness for purpose. A successful technology improves the quality of life for a human being without damaging the quality of life of another. Technology education needs a significant focus on what is possible and worthwhile (Barnett, 1994).

Technological activity ultimately involves human choice. In some sense people choose, but most people do little in the way of choosing the world they live in. More strategic choices have been made elsewhere. Paradoxically technologies such as electrical goods and services are beyond the command of the consumer. The complexity and interconnectedness of technological activity is such that there is rarely a straightforward relationship between purposes, design and outcomes (Barnett, 1994).

Not all products of technology are received without question. There is debate on issues as varied as genetic manipulation, nuclear engineering and air pollution. The technologically literate student must understand the relationship between technology and social change and the forces brought to bear on those who make the decisions about the benefits that accrue from these products of technology. There is an elite group with political and economic resources which drives the large scale production of a technology if it seen as useful in maintaining or

enhancing its position. A counter-elite can stop the diffusion of the technology if it can muster enough support. It is when a new technology causes social strain that assessments and legislation are introduced to control the technology. A critical component to be taught to students is that the relationship between technology and society is reciprocal. Students need opportunities to examine how actions have an impact on the course of a technological development; and how to examine the arguments presented by the developers of technology in support of their position (Fleming, 1989).

The experience based nature of technology education can contribute significantly to the development of constructive attitudes towards living and working in a technological society and the impact of technology on the environment. When the students' technological activities involve their school and community life, the goal is for the students to become adults who can reconstruct and improve society. Technology is used as a vehicle for attacking social concerns (Zuga, 1992). As well as students examining how their actions can have an impact on the course of technological development they need to be taught how to examine the arguments presented by the developers of technology in support of their position (Fleming, 1989). The challenge is to help students take a stand on issues confronting today's society and not remain isolated in the school environment. It is easier not to reveal one's ideology (Zuga, 1992).

2.2 Food Technology

2.2.1 Characteristics of Food Technology

Food technology is concerned with all the technical aspects of the production of food in its passage from the field to the plate (McLaughlin, 1997). Food technology is a highly interdisciplinary field of study incorporating concepts from science and engineering. Food technology also interfaces with many other disciplines such as microbiology, sensory analysis, food packaging, gastronomy, and nutrition. Applications of food technology are further concerned with economics and marketing; regulatory aspects; quality assurance and control; as well as the food preferences of various populations.

Food science and food engineering share the same goals of producing high quality, appealing, and wholesome food. Food science deals with the processing of food including food preservation; the creation of new food product forms; the improvement of sensory and nutritional qualities of food; convenience foods; and food safety. The food scientist understands the chemical and physical properties of foods and their constituents, and the changes these may undergo during their processing and preparation for consumption. Food engineering is more concerned with the industrial processes used to manufacture food. Food technologists use their skills to develop new, improved products and devise more economical production processes to facilitate product development (Massey University, 2010; University of Otago, 2010).

The activities of food technologists are seen in the wealth of commercially produced and packaged foods available to today's consumers. These products of food manufacturing differ from traditional foods of plant and animal origin which have undergone minimal processing. A major difference between foods and other products of technology is that foods are unstable; they decay over time and become unusable (MOE, 2005). The food manufacturing industry has arisen from the need to extend the shelf life and availability of seasonal foods. Nestle (2002) describes the food industry as the successful result of twentieth century trends that led from small farms to giant corporations; from a society that cooked at home to one that buys nearly half its meals pre-prepared and consumed elsewhere; and

from a diet based on whole foods grown locally to one based largely on foods that have been processed in some way and transported long distances.

Developments in food technology arose in ancient times as is apparent in the food biotechnological products of bread, beer, and cheese. Research in the field now known as food technology has been conducted for decades. Nicolas Appert's development of the canning process in 1810 was a decisive event. Louis Pasteur's research into food spoilage and pasteurisation around 1864 put food technology on a scientific basis. The later developments of refrigeration, freezing, drying, and packaging have contributed greatly to the food supply. Convenience foods have evolved from sliced bread, first produced in 1930, to the heat and eat microwavable meals of today (Morris, 2003).

New Zealand has contributed, and continues to contribute, to the history of food technology innovations. The advancement of New Zealand's meat and dairy industries hinged on the freezing technology used to transport meat and dairy products from New Zealand to the United Kingdom in 1882. Incorporating technological advances into farming practices and milking techniques has been a major factor in the continued success of these food industries (Techhistory, n.d.).

The food and beverage industry is the lynchpin of New Zealand's prosperity. Food and beverage exports represent half of all New Zealand's exports by value (New Zealand Trade and Enterprise, 2010). The industry has a crucial influence on the nation's economy. The New Zealand food industry maintains its strong focus on developing meat and dairy products. Adding value to fruit, vegetables and grains, with a particular emphasis on post harvest technology, is another broad area of technological development that New Zealand contributes to the food technology community world-wide (Massey University, 2010).

The New Zealand food industry continues to grow as people increasingly view the interaction between food, nutrition and lifestyle as central to a long and healthy life. Consumers are demanding convenience products that are minimally processed, flavoursome, palatable, safe, nutritious, and available throughout the year (Massey University, 2010).

Significantly, New Zealand food technologists assume a role in food education and promotion. This is particularly evident at tertiary level where critical thinking

is encouraged. Tertiary students are taught that as food technologists they will be accountable for the development of technically and ethically responsible practices that will benefit the community. How food production, promotion and marketing are influenced by historical, social and cultural factors are important understandings to be cultivated alongside science and engineering (The University of Otago, 2010).

Pilizota (2004) says food science and technology should be of national importance to every government. Food scientists and food technologists, with their knowledge of nutrition and familiarity with agricultural technologies, can provide better health and quality of life, and can reinforce a nation's economy. The food technological knowledge and understandings needed for the 21st century need to answer the questions: what is needed to make food safer; what does it take to better deliver health benefits from food; how can processing companies develop environmentally-friendly technologies; and what break-through developments will capture the edge in global markets. Collaboration among government, industry and academia is necessary to advance a nation's expertise in food (Piližota, 2004).

2.2.2 Food technology and education

Food technology in school is not the same as food technology in the 'real world'. Technological activity in school centres on the practical. Technological knowledge and understanding develops in accordance with the particular issues with which students are concerned (McLaughlin, 1997). The unstable nature of the raw materials for food products creates a need for a body of knowledge that is unique to food technology. Technological activities and learning approaches that will help students achieve the objectives of the food technology area of the curriculum "... include understanding and using safe and reliable processes for producing, preparing, presenting, and storing food and the development, packaging, and marketing of foods" (MOE, 1995, p. 12). McLaughlin (1995) elaborates this definition to encompass the production of palatable and nutritious food, menu planning and diet, and the needs and preferences of the consumer.

Specific skills are needed for a successful food outcome. Acquiring a skill set around food and cooking determines the basic ingredients of a food technology programme:

- Care and precision following a recipe
- Confidence communicating the language of specialised terms for techniques and processes
- Accuracy with weights and measures, and temperatures
- Consistency implementing food hygiene and safety codes of practice
- Safe use of equipment

Learning to cook is also described as a stimulating and refreshing adventure and a constant source of creative pleasure. The social/human context within which food is prepared is never far away because choosing food means making personal decisions. There are many factors affecting food choices such as life style and eating habits formed over years, likes and dislikes, race, religion, cost, availability, and time spent preparing food. There are also the outside pressures of advertising, food fashion trends, impact on health, nutrition campaigns, and new technological innovations (Palmer, 1984).

Food technology exists within a societal setting. Different cultures view food in different ways. New Zealand classrooms encourage students to look beyond their narrow cultural bounds to view the world from different perspectives. Students critique decisions in terms of their likely effects on different groups of people. Constantly changing food patterns reflects New Zealand's history and cultural diversity. The story of New Zealand's immigration is integral to New Zealand's past and continues to be of key relevance to the future (Bawden, 1999; Bell, Benfell, Hayes & Pascoe, 2001).

Teachers play an important role in fostering knowledge and understanding about food and nutrition. There is a growing recognition that the health of an individual and their health-related behaviours are the product of that individual's continuous interaction with the environment. Learning the practical skills of cooking can provide young people with opportunities to prepare and taste new foods; and become critically aware and rely less on food products that do not contribute to their well-being (MOE, 1999). There is a significant contribution to knowledge when health and food skills are explored together. Motivation is increased and learning is more likely to be retained when there is interaction between practical activity and theory work (Jones, 1997).

The topics in a school foods programme provide opportunities for integration of food technology concepts with other technological areas such as biotechnology and production and process technology; and with other learning areas including science, health and well-being, and social studies. For example, studying the food habits of another country will give students new insights into how ethnic, climatic, religious, and geographical features affect the food grown and cooked. Of particular interest to New Zealand students are the countries from which people have migrated here and those countries to which New Zealand exports (McLaughlin, 1997).

A range of knowledge bases contribute to food technology programmes in schools. Students bring these to bare in finding solutions to their technological problems. It is important that students investigate how these ideas influence technology and technological developments. They need to examine the interrelationship between food technological outcomes and society and think about new developments from a position of understanding; the technology itself and the different views people have about technology; and how these views are influenced by beliefs, values and ethics (Jones, 1997).

2.2.3 Implications for teaching and learning in food technology

Historically food technology as an area of study developed from early technical curricula. The practical skills of making things were most important. Cooking was introduced for girls with the purpose of enabling women to improve the quality of their homemaking (Burns, 1997). The content of foods courses reflected the society and cultural values of their time; reinforcing women into subservient roles; confining their responsibilities to the home and family (Turner & Seemann, 2006). Street (2006) says perceptions around women being responsible for household tasks still exist. A challenge for today's technology educators is to overcome the segregation of technologies by gender and the perception that technology does not involve higher order thinking (Burns, 1997).

Inconsistencies with naming conventions of foods related subjects in schools indicates teachers' philosophical understandings lack clarity of the differences between the health and physical education and technology curricula (Street, 2006). The subject area has not been adaptive to contemporary holistic

understandings and demands a fresh approach (Turner & Seemann, 2006). Professional support and relevant resources can help address barriers to student learning arising from inconsistencies in perceptions and delivery of food technology as a subject.

The New Zealand curriculum's definition of food technology described as "... the safe production and processing of food, and the development packaging and marketing of food" (MOE, 1995, p.12) is a radical shift in emphasis from the domestic context, to an industrial and commercial context. The use of the word processing rather than cooking suggests a de-domestication/industrialisation process. When making jelly or popcorn for example, Stitt (1996) asks does this really mean processing as carried out in the factory or is this an attempt to avoid using the word cooking. The curriculum is lacking in real hands-on experiences in preparing food, and the term cooking is mentioned but not very often. Scientific and technical speak acquires more legitimacy than ethical speak. There is a blurring of meaning which is confusing for teachers and students. Food placed in such a narrow perspective accentuates the power of industrial hegemony and denies the multi-faceted nature of food as an area of study. Stitt (1996) highlights the importance of establishing what is meant by food technology and what should be taught within that framework.

Eagle and Pound (2007) have adopted a literal interpretation of the MOE's (1995) definition of food technology. They describe a body of knowledge which is unique to food technology. They have developed a resource for New Zealand teachers, which contains the type of information that a food technology student could be exposed to over a six year period, years 7 to 12, of studying food technology at school. The resource which they have named the *tool box* describes information that would allow a student to undertake an independent project within an area of food technology in year 13. The *tool box* gives teachers of food technology guidance on appropriate knowledge and techniques from a variety of academic areas including physical and biological science, and language and design. There are five topics: food formulation, safety and legislation, production, packaging and labelling, and product testing.

According to Jolley and O'Neill (2001) the approach to food studies within the New Zealand technology curriculum, with its emphasis on food as a technology,

takes the food out of the domestic sphere and locates it in a realm of commercial production, processing, manufacturing and marketing. They suggest that the food technology curriculum is responsible for deskilling young people in terms of their ability to work with basic, natural, food ingredients to feed themselves and their families. A commercial view of food production results in a functionalist approach to food which only emphasises the useful changes technology brings. The implications of convenience and fast foods for families are not understood or investigated through the approach legitimised in this curriculum. Jolley and O'Neill (2001) are critical of a curriculum that is limited in its provision of the exploration of the technology-society relationship which is central to a critical analysis of the power relations embodied within technology and through its practice. Jolley and O'Neill (2001) recommend a distinction between programmes designed to teach food technology and those that are limited to teaching cooking skills.

The Office for Standards in Education (OFSTED) (2006) reported on a small survey into the teaching of food technology within design and technology (D&T) in 30 secondary schools in the UK. The report states that in recent years, pupils, parents and headteachers have expressed their concerns about food technology in the curriculum to government officials and inspectors, namely that too little time is spent learning to cook nutritious meals and too much time is devoted to low level investigations and written work, the value of which is unclear. Pupils are required to engage in complex product development before they have an adequate understanding of food ingredients, nutrition, hygiene and cooking skills. The report concludes that achievement across all aspects of food technology was rarely better than satisfactory. Some of the more abstract elements of food technology were beyond the capacity of younger pupils and those of lower or average prior attainment. The report makes detailed recommendations about the steps that national bodies should take, particularly to clarify the nature of food technology within the secondary curriculum.

- Define the knowledge and understanding and skills which pupils should be taught in relation to cooking, nutrition and healthy eating and incorporate these redefinitions into the programme of study for D&T using terminology appropriate to food

- Clarify the relationship between the teaching of food as a life skill and the use of food as a medium for teaching design and technology in order to remove the confusion fro teachers and curriculum developers
- Reconsider the demands made by the full spectrum of food and technology – ensure the subject meets the demands of all pupils

According to Rutland (2008) the standards of achievement in the UK schools are limited by a lack of understanding of nutrition, restricted cooking experiences, and poorly understood product development. A fundamental tension is seen between cooking as a life skill and as a medium for teaching technology. Ideally food technology should embrace an understanding of the properties of food materials and be able to apply this to developing food products. In many schools pupils need more opportunities to learn the practical skills of buying, cooking, and storing food. This should be linked to the underlying nutritional knowledge needed for them to be able to choose to eat healthily. Such learning needs to be well secured before pupils embark on more abstract and industrially oriented courses in food technology. Combining the twin goals of developing life skills; and designing and making in food technology can be described as too ambitious and open to problems in the classroom.

Turner and Seemann (2006) say that the subject has failed to accommodate an association with the changing knowledge in food innovation and research. Food technology has relatively low esteem in the curriculum as a job pathway into the food technology industry. The view projected of the subject by many is that food technology is about the development of culinary skills and nutrition. Technical skills cannot be defined independently of the social and environmental context. Alongside cooking tools and culinary skills a contemporary food technology programme will have deep emersion into areas such as agriculture, horticulture, human sustainability, nutrition, resource reliance, climate change, materials, packaging, and new food innovations (Turner & Seemann, 2006). Within the context of activities in food technology, the body of knowledge around food and nutrition is one theme informing student learning (Street, 2006).

The place of food in the education system should be assured. Stitt (1996) suggests that this is not the case. Stitt (1996) presented an international perspective of food

and cooking skills in education by examining curricula in Britain and nine other countries including New Zealand. Stitt (1996) was concerned that the teaching of food skills was in danger of being lost from the British school curriculum and that this would have implications for the teaching of cookery and the food and eating traditions of British society. An ideal food culture is one where people cook from fresh and local ingredients. Home cooking involves less packaging material, less energy consumption, is higher in nutrients and more environmentally friendly. A focus on food production in a domestic context maintains the rituals of familial and cultural food preparation and is personally empowering. Cultural and social contexts of food production and their roles are acknowledged (Jolley & O'Neill, 2001).

Developing nations demand more and more fast foods. These items increasingly dominate the diets of households, encouraged by the deskilling process inherent in the curriculum. There is a greater reliance on pre-cooked convenience foods which are in general nutritionally inferior to home cooked meals and generally more expensive. There is a concern that the nation's diet will be adversely affected and in turn the nation's health (Stitt, 1995).

In 1995 the Commission for the EU presented a case for education as a vehicle for promoting food knowledge, changing attitudes, developing culinary skills, improving the acquisition of healthy eating habits, and encouraging greater autonomy and responsibility among young people (as cited in Stitt, 1996). Stitt (1996) described the New Zealand curriculum as treating food skills in exactly the same way as the British education system even though the Public Health Commission's advice to the then Minister for Health proposed that the education system promote food and nutrition as a priority area in the school curriculum (as cited in Stitt, 1995).

Smith and Katz (2006) are optimistic for the success of a constructivist teaching and learning approach in programmes teaching about food. Their review showed students as remaining on task, being engaged, and learning facts while solving a problem concerning the appearance and taste of salad greens. This is one example from many real world contextual problems and questions that can be posed in the foods subject area. Issues such as hygiene in the kitchen, food safety, the content, appearance, and taste of foods, as well as healthy food choices, can all be framed

as practical problems for students to solve. Students will find this knowledge helpful for both careers in the food industry and in the work of the home. Students learn content as effectively as through a theory lesson. The problem solving technique provides a structure for discovery that helps students internalise their learning and leads to greater comprehension. Its effectiveness depends on the teacher selecting an appropriate task, the nature of the student engagement, and the availability of resources (Smith & Katz, 2006).

There is much to be learned about the contemporary subject, food technology, from a study of its roots and journey to today. A number of writers in different parts of the world suggest that the value of learning in food technology is unclear; that perhaps students are being asked to engage in product development before they have an adequate understanding of food ingredients, nutrition, hygiene, and practical cooking skills.

Technology plays an important role in food product development and the way food is produced, processed, packaged and marketed. An understanding of the links between food, processing, nutrition, health and well being is a high priority in contemporary society. The study of food and technology challenges students to make these links and provides them with the opportunities to acquire knowledge and skills to make informed choices when selecting, storing, purchasing, preparing, and consuming foods that contribute to a healthy lifestyle.

2.3 History

2.3.1 What is History about?

History is an understanding of the past, a description of events that have taken place and a witness that testifies to the passing of time. History tells the story of human social life, events, acts and ideas found worthy of note from previous times. History is further described as a dialogue between the past and the present, a reconstruction and analysis of events that have taken place (Carr, 1961). Pope Benedict XV1 (2006, May 28th) said that to understand today we must search yesterday. The past is never simply the past; it always has something to say to us. It tells us the paths to take and the paths not to take.

We can learn from the past; how previous generations thought and acted, how they responded to the demands of their time, and how they solved their problems. We learn from analogy, not example, for our circumstances are different (Lerner, 1997). All history is the work of human beings like ourselves. Modern history is the history of our civilisation and of those recent centuries during which our civilisation has taken the form with which we are familiar (Dunn, 2000).

2.3.2 Why study History?

A central mission of history education is for the rising generation to make sense of developments that have involved peoples of differing cultural traditions in a shared heritage of experiences, values, institutions and great ideas. The study of modern history allows us to see how much interaction there is among all peoples in all times, and how important those interactions are in determining the course of human history. Most facets of experience that are found in any major tradition can be found in corresponding traditions elsewhere (Dunn, 2000).

Among the aims for history education in New Zealand is for students to develop a deeper awareness of themselves as New Zealanders – their heritage, cultures, and shared values – and an understanding of New Zealand's past and its position in the wider world. Historical scholarship encourages students to look for points of connection and for similarities and differences (MOE, 1990).

Through history students can learn historical understanding, the fundamentals of causation, sequence and relationships that distinguish historical thinking from

heritage – traditions passed down from preceding generations. It is through systematic, fully informed, thoughtful examination of social context that the many ways problems are posed and resolved in society are understood. We learn to weigh the different interests, beliefs, experiences, and circumstances that guide human beings both in the past and in the present; how beliefs, experiences, and circumstances drive human beings to construct knowledge and make us aware of the value of knowledge and its nature (Morton, 2000).

Lowenthal (2000) describes three reasons why it is crucial to study history. Historical understanding contributes to everyday affairs; there are benefits recognising the foreignness of the past; and there are virtues of hindsight – seeing the past's ongoing consequences. Lowenthal (2000) says that at the start of life human beings are immured in the present. As children grow, memory and expectation provide awareness of a personal past and future, but history – that remote epoch before our being – long remains shrouded in obscurity. Adolescents give little thought to what the past might have been like. They have a tendency to perceive historical phenomena as exotic, remote, and unconnected to present experiences (Dunn, 2000). That denizens of past times were actual people is hard-gained reflective insight and teachers need 'magic' skills to engender empathetic interest in the past in young minds (Lowenthal, 2000).

Hindsight enables past events to be to be seen not only as contemporary eyes and voices but also in terms of what has later unfolded. It lends the past a coherence, consistency and reliability it never possessed for its denizens, for whom the past was a messy confusing present. Hindsight is essential to how the past is viewed and explained. The deficiencies of youth can be outgrown by instilling in them the conviction that they are already participants in history; not only are they embedded in time they are destined to shape it (Lowenthal, 2000).

2.3.3 How students learn history

Understanding history is more than critiquing stories or encountering multiple perspectives. For students to develop competence in an area of enquiry, they must have a deep foundation of factual knowledge that is treated seriously, well understood, and delivered in the context of a rich conceptual framework. A goal of studying history is for students to know something of the past. A large part of

thinking and knowing involves making claims on the past. Tools for thinking about the human world in time are for students to develop frameworks of history that can be used to assimilate new knowledge (Bain, 2005).

Leinhardt (2000) describes a world of crises, successes and patterns that do not spring forth unattached. Students and many adults do not know the routes and roots of current circumstances and that they could and should look for them. Leinhardt (2000) wants students to know there is a past and go looking for it when confronted with issues of the present.

Attempting to examine the present through the lens of history carries with it important risks (Boix-Mansilla, 2000). Boix-Mansilla (2000) suggests students may believe they can know the lives of the people in the past in the same way they know their contemporaries. Conversely they may come to believe that understanding the lives of individuals and societies in the past yields immediate understanding of societies in the present. Teachers are left with two pedagogical options: teach the past carefully and rely on the hope that students will appropriately bring to bear historical knowledge and analytical tools when they confront social processes in the future; or scaffold students to make connections by giving them multiple opportunities to do so, identifying difficulties and orienting their efforts (Boix-Mansilla, 2000).

In the late 19th century the psychologist Stanley Hall said the value of history teaching is too great to be left to teachers keeping a finger on the place in a textbook. He urged teachers to saturate history teaching with more active pedagogy to make it more effective and engaging (Bain, 2005). Teachers must offer the intellectual and historical context necessary to provide meaning and coherence across discreet objectives. Teachers help students learn to think historically. They pay attention to the multiple facets of historical knowledge. They do not sacrifice the substance and rigor of the discipline of crafting problems to study. Good problems look both to the contours and details of historical stories asking for example what explains differences in technology over time. Working with such problems requires students to grapple with important historical details while extending their understanding of, and skill in, using key historical concepts such as significance, cause and effect, change and continuity, evidence and historical accounts.

Parents, television, movies, and museums contribute to students learning history outside of school (Leinhardt, 2000). The process of developing historical thinking demands that instruction go beyond school to embrace film, newspapers, archives, citizens' initiatives and other evidence of lives lived in historical cultures. Adolescents will experience at least 60 years of important history over the course of the rest of their lives (van Borries, 2000). The past is part of the present. The sense of connectedness to the past and between the past and the present that is found in everyday life must be infused into teaching activities (Rosenzweig, 2000).

Students can learn about the past from a museum visit (Morton, 2000) such as a living-history site. Lowenthal (2000) cautions impediments to historical understanding through visits to living-history sites. Folk of past times are usually viewed in comparison with the present. Awareness of historical difference remains partial and tentative. Guides try hard to be non-judgemental but still end up displaying the past as an aberrant present, sometimes superior, usually inferior to today in aesthetics, behaviours and beliefs. Past motives are explained in terms of present morality. Visitors are invited to pity the past, to laugh at its absurdities or mock its backwardness. Bain (2005) too says that despite the enthusiasm hands-on activities generate, they do not automatically foster historical thinking. Teachers need to transform both traditional and newer pedagogical methods to help deepen students' historical understanding.

Glimpses into dissimilar pasts can however be accessed through dynamically inspired portrayals of them encountered in a living-history museum. Visitors are invited to enter into the day-to-day circumstances of real people from the past. Such experiences can be a vital adjunct to history teaching. The aim is for students to think historically; to have empathy with and understand what the past was like; to clarify present circumstance. The teacher's task is to keep antiquity accessible while stressing its unique foreignness (Lowenthal, 2000). Chronicles, diaries, records, books, paintings, and buried trash reveal much that is familiar with the past. A challenge in history education is to reduce to some extent the weirdness of the past and to build bridges of comprehension between students and the departed (Dunn, 2000).

If history is to affect the lives of students for the better then it needs to be intentionally connected to what goes on outside the classroom and the school. The lives of our ancestors have proceeded within contexts. Making connections with a community external to the school can yield a deep sense of historical empathy and positive attitudes towards oneself, others, and history. The purpose of the community is to proffer a safe, interesting and challenging setting in which to learn. It also sets the context of learning history by manifesting the contexts of history (Gutierrez, 2000). Interacting with specialists improves what students take away from history lessons (Stearns, 2000).

2.3.4 Food and History

The concept of social history has been broadened to embrace the entirety of the human past. An understanding of the fabric of past cultures must include the significance of basic human phenomena such as food consumption and cuisine patterns. There are many examples of food patterns that portray the interrelationship of social history with food consumption. The influence of geography upon cuisine patterns is readily apparent. The evolution of a particular dish or food such as wheat; the natural wealth of a community reflected in the varieties of food available; the evolution of social class distinctions seen in the fare of various social strata; the intimate relationship between religious customs and practices illustrated in celebrations, feasts and fasts; the influence of foreign rule and trade discerned in the cosmopolitan dishes adopted; and the implications of famine or poverty reflected in patterns of emigration; all show that much can be learned about social changes within society by the study of food consumption and cuisine patterns. It is however more difficult to assess the impact of social patterns in causing social change (Gordon, 1974).

A more recent example of social differentiation is reflected in the decline in quality of (French) cuisine as a result of a growing consumption of convenience foods (Ardagh, 1968, as cited in Gordon, 1974). Today's cuisine patterns are affected by the increased pace of technology and communication; rising standards of living, increased trade; secularisation of modern life; and changing urban and rural agricultural and social patterns (Gordon, 1974).

The historian Eileen Power's call in 1924 to enter the kitchens of history is a valid one for history must be concerned with the totality of the human past (Gordon, 1974).

2.3.5 Education and the history of food

Food like art and literature is a reflection of culture and much can be learned from tracing food patterns through the ages. The history of food is one of change. Studying foods from the past helps people comprehend the progress society has made in understanding not only history facts but also progressions in technology. The global food market of today is a result of technological advances in food science and engineering; food preservation and transportation; as well as nutrition and health.

Through studying the history of food students have the opportunity to learn how certain actions and decisions brought about events and what the consequences of those events were. They can explore benefits to health of agricultural, medical, pharmacological, and other technological advances. Students can learn how different civilisations survived, ate, lived, and cultivated the land. They can compare what was once eaten, how it was produced and cooked with eating patterns of today. Students might look at the well being and growth of their own generation and the impacts of food processing on the future.

Teaching about the past while also teaching students how to critique and evaluate the past is a complex task. Historical literacy, developed through multiple learning activities around the history of food production and food technologies for example, centres around students becoming familiar with some facts that educated people should know, and to gain some factually derived perspective at the same time. Students need understandings and capacities that can be applied to new data and issues; understandings that will help them as citizens (Stearns, 2000). Stearns (2000) says it is crucial and relevant especially in high-tech environments for young people to know how to assess and compare change; how to compare different social patterns; and understand how people behave.

It is equally important to remember the pleasures that a historical study can provide both to teachers and students. In what other field of study can students experience such a range of possibilities and get to know so many people and

places; life in a different society and culture (Bain, 2005). Studying the past by recreation period cooking is one of the few activities that goes substantially beyond merely learning things that other people know.

A disciplined study of history promotes exactly the type of reasoned thought students deserve to have and societies need (Bain, 2005), for the capacity to think historically enhances an ongoing understanding of how societies work (Stearns, Seixas, & Wineburg, 2000). Another guiding premise is that technology — as knowledge, practice, and material resource — has been a key site for constituting the human experience. In the modern era, it becomes central to our understanding of the making and transformation of societies and cultures, on a local or global scale (Morton, 2000).

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2.4 Learning Experiences Outside the Classroom

In a broad sense the term *learning experiences outside the classroom* can be described as structured curriculum linked learning experiences that take place beyond the classroom environment during the day, after school or during the holidays (MOE, 2008; Kendall, Murfield, Dillon & Wilkin, 2006). Learning outside the classroom is about raising educational achievement and reducing disparity through an organised, powerful approach to learning in which direct experience is of prime importance. It is not only about what is learned but importantly how and where the learning takes place. Experiences outside the classroom provide an ideal context for learning (Department for Education and Skills, 2006).

Students should experience the world beyond the classroom as an essential part of learning and personal development. Such experiences equip them with knowledge, skills, attitudes, and values to be successful citizens. Learning experiences outside the classroom enhance learning in all areas of the New Zealand curriculum (MOE, 2008).

The role of educating outside the classroom is to provide learners with relevant and enjoyable experiences which complement and enrich the teaching and learning of the classroom. Within a given context students are provided access to unique tools, objects, exhibits, artefacts and expertise. Carefully constructed learning opportunities can help students develop new understandings and ideas; problem solving skills; as well as life skills such as inter personal cooperation. Further goals of learning outside the classroom specifically include providing opportunities for students to increase their awareness and appreciation of the traditions and values of New Zealand culture and heritage (MOE, 2002). Learning experiences outside the classroom involve students in gathering information and reflecting and thinking critically; stimulated by interesting and challenging activities.

Examples of contexts that promote learning outside the established formal system are diverse. They include outdoor recreation and education, and adventure experiences as well as other wide ranging curriculum linked programmes

provided by zoos, museums, maraes, historic parks, art galleries, performing arts centres, and environmental and science centres.

2.4.1 Experiential learning

The roots of experiential learning are found in the philosophical works of the early twentieth century American philosopher and psychologist John Dewey. Dewey is a famous advocate of hands on learning or experiential education which is described in his writings as education that infuses direct experience with the learning environment and content. There are several recurrent themes throughout Dewey's writings: education and learning are social and interactive processes; students thrive in an environment where they are allowed to experience and interact with the curriculum; and all students should be allowed to take part in their own learning (Dewey, 1963).

Dewey (1963) discusses how the environment offers educational experiences. The past is a potent agent in appreciation of the living present. Dewey (1963) says we live from birth to death in a world of persons and things because of what has been done and transmitted from previous human activities. Sources outside individuals give rise to experience. The challenge is discovering the connection, which actually exists within experience, between the achievements of the past and the issues of the present. Educators can utilise the physical and social surroundings that exist, so as to extract from them, all that they have to contribute to students building worthwhile experiences (Dewey, 1963).

Allied perspectives on contextual learning are reflected in the constructivist approach to learning which has been and is still being championed by educational researchers. McCormick (1997), Hennessy (1993) and others describe a situated view of learning where the interrelationship between learning and knowledge is tied to the context within which the learning takes place. Students learning through observing, enacting, and participating as a member of a community is inherently context dependent. Brown, Collins and Duguid (1989) refer to this as the theory of cognitive apprenticeship.

Harrison (1970) has long been a proponent of learning out of school. Harrison reminds us that learning opportunities pervade the whole environment. Knowledge generation is an active process gained through personal experiences

that happen at different times, at home, on the street, on the bus, watching television, in the theatre, as well as in an art gallery or museum. Resnick (1991) too brings to mind the notion that our lives are filled with instances in which we influence each others' constructive processes by providing information, pointing things out to one another, asking questions, arguing with and elaborating on one another's ideas (as cited in Rennie & Johnston).

Experiential learning engages the learner at a personal level by addressing their individual needs and wants. Characteristics of experiential learning are no different from how humans learn on a daily basis. It is personal, contextualised, and happens over time. As experience is the source of learning and development, a facilitated, well crafted experiential learning environment is more likely to be fun, stimulate the imagination, and keep the learner engaged for longer. To be effective however the learner requires qualities of self initiative and evaluation, and needs to be willing to participate in the activities.

Mainstream educators recognise that in-school education might benefit from work done on learning out of school. Learning experiences outside the classroom are enjoying a revival because recognition is being given to the more active style of learning. Out of school and in-school learning advance through collaborative, social inclusion and social construction of knowledge (Brown, Collins & Duguid, 1989).

2.4.2 Museums

Scheduled visits to museums are favourable activities for student learning experiences outside the classroom. Alexander (1979) describes museums as collections of the beautiful and curious. Museums collect and care for art, historical rarities, scientific specimens, and equipment. They research, communicate and exhibit (Alexander, 1979) the tangible and intangible heritage of humanity and its environment for the purposes of study and education, enjoyment and inspiration. Falk and Dierking (2000) describe museums as public places for personal learning; places people seek to satisfy their learning needs. Museums are also places which contain real things, made, used, and collected by people. They bestow reality and life to familiar facts (Harrison, 1970).

There are many categories of museums including science, technology, history, art, and many more, including smaller museums that focus on specific themes. Most museums share a commitment to providing enjoyable, public, free-choice learning opportunities through a similar array of educational media, exhibitions, programmes, and presentations. The general public and organised groups, such as groups of school students, take up opportunities to visit museums on the assumption that they will find meaning (Falk & Dierking, 2000). Falk and Dierking (2000) are confident that people do learn, make meaning, and find connection through museum visits.

Characteristics of museum learning

The learning that occurs in museums is of a unique and special nature. It particularly emphasises informal, personally motivated learning, where the visitor has considerable choice as to what to learn, as well as where and when to participate in the learning. Understanding the context and quality of exhibitions and programmes is necessary but not sufficient for understanding the complexity of museum learning (Falk & Dierking, 2000). Museums need to show how the learning experiences they provide fit with broader educational frameworks and lifelong learning (Kelly, 2003).

Museum learning is different from traditional conceptualisations of learning such as that in classrooms. Museum learning is considered more holistically as a whole-body, whole-brain activity, and is characterised by the contextual model of learning (Falk & Dierking, 2000).

2.4.3 Contextual model of learning

Experiential learning theory contributes to an understanding of contextual learning. Contextual learning arises from an outside of the classroom experience within a specific context – for example a visit to a museum. A contextual model of learning starts from the premise that all learning is situated. Learning is a dialogue between the individual and the learning environment. It is happening in the real world, with real objects (Dierking, 2002). All variables and circumstances of a museum visit help the learner to contextualise what is learned (Rennie & Johnston, 2006).

The contextual model of learning espouses three overlapping contexts contributing to and influencing the interactions that people have with objects, and the consequent learning and meaning making that ensues (Dierking, 2002).

Personal context

All learners bring to the learning situation their internal motivations, preferences for learning modalities, prior knowledge and experience (Dierking, 2002).

Motivations

Each museum visitor has their own unique personal experience and constructs their own learning. The learning experience requires engagement on behalf of the learner for meaning to be made from the experience. The individual's past experience helps structure the new learning in personal ways (Rennie & Johnston, 2006).

Personal context learning also describes a rich emotionally laden experience. It is never just facts and concepts. Individuals are motivated to learn when they feel comfortable in a supportive environment; are freed from anxiety and other negative states; and are engaged in meaningful activities where challenges meet their skills. Learning becomes personally satisfying and rewarding (Falk & Dierking, 2000).

Learning modalities

Research and understanding how the human brain processes information and creates memory supports understanding learning modalities. The brain prefers complex, multi path learning. It simultaneously operates on many levels, processing all at once a world of colour, movement, emotion, shape, intensity, sound, taste, and more. Educators make use of memory created through sights, smells, tastes, touch, location, and emotions. The emotional content of a rich, multi modal learning activity establishes emotional triggers that enhance storage and retrieval of memories from the experience (Shepherd, 2010; Jensen, 1994).

Each person prefers different learning styles and techniques; sometimes with one learning style dominating. Learning experiences outside the classroom acknowledge and are suited to different learning styles such as visual, aural, and

kinaesthetic learning. Learner motivation is increased when the experience involves concrete, verbal, and visual details (Jensen, 1994).

Prior knowledge and experience

Visitors do not come to museums as blank slates. Previously acquired knowledge, interests, skills, beliefs, attitudes, and experiences all interact with educational experience and meaning making. They lay the foundation for better comprehension, recall, and what is ultimately learned. New information linked to prior knowledge fuels the visitor's interest and curiosity granting them control over their learning (Dierking, 2002; Falk & Dierking, 2000). Visitors' own backgrounds, experiences, interests, social skills, combined with current understandings about the information on display, infuse the learning with a sense of purpose (Rennie & Johnston, 2004). Contextual clues from the outside world would be otherwise meaningless (Falk & Dierking, 2000).

Sociocultural context

The nature and outcome of a visitor's museum experience is facilitated by other people, and the visitor's interactions with them, together with the social and cultural features associated with the artefacts and exhibits (Rennie & Johnston, 2004).

Social interaction is an important aspect of museum trips and if respected and capitalised on can result in increased learning. Sociocultural learning encompasses factors that recognise that learning is both an individual and a group experience (Kelly, 2003). Learning and meaning making takes place within a community of learners. Social groups utilise each other as vehicles for deciphering information and reinforcing shared beliefs. Learners have the opportunity to explain their learning to others particularly their peers. Learners remember discoveries better and are able to transfer new insights to new situations. Learners appreciate optimum conditions under which to learn by expressing dislike for certain negative aspects such as crowding (Dierking, 2002; Falk & Dierking, 2000).

Understanding the social world is a fundamental building block of learning. Sociocultural learning is inextricably bound to the cultural and historical context in which the learning is centred (Dierking, 2002). It is a process by which society

shapes the mind and creates the kinds of persons who are able to meet the imperatives of the culture. Museum displays represent the distinct customary ways of living and the artefacts that people have made that characterise society. Social interactions create, change, and pass on culture. Culture in turn influences society (Falk & Dierking, 2000).

Sociocultural learning in the context of a school museum visit is enhanced when the teacher links the visit to the school curriculum and embellishes the unit with varied classroom activities (Falk & Dierking, 2000).

Physical context

The physical context refers to the physical aspects of the environment of the museum visit. It comprises the architectural features, the exhibition layout, the exhibits, their labels, and so on (Rennie & Johnston, 2004). The physical context is not isolated from the real world and includes the feel of the situation; the design features; as well as the sights, sounds, and smells of the experience (Dierking, 2002).

When asked to recall museum features, visitors most frequently and persistently recall aspects of a museum experience related to the physical context. Visitors describe their memories of what they saw and did and how they felt about those experiences (Dierking, 2002). Falk and Dierking (2000) say that all learning seems to be inextricable bound to the environment in which it occurs. Authentic, appropriately designed exhibitions are compelling learning tools, and arguably the best educational media designed for facilitating understanding of the world.

Objects

The raison d'être of any museum is the collection of objects. Part of what makes a museum a unique learning setting is the fact that multiple ways of interacting around and with objects is encouraged. Objects – technologies and tools – channel the nature and focus of interpersonal interactions which in turn mediate the development of children's higher order thinking. Children become skilled at viewing objects, inferring their uses and history. In history museums objects are cues for institutional memories of past events and personally reconstructed memories (Rowe, 2002).

Museums do not always allow physical contact with their associated artefacts but there are some that are interactive and encourage a hands-on approach. Access to museum objects, knowledge, and information provide visitors with opportunities to see themselves and their culture in ways that encourage new connections, meaning making, and learning, in a physical environment (Kelly, 2003).

When students interact with different tools, artefacts, and objects they use different senses, and their learning is enhanced. Objects help shape student thinking as actions may influence the development of knowledge. In addition, students may recall what they have learned more readily when they have used tools and artefacts because their experience with a real object may act as a prompt that draws their learning together (MOE, 2008).

The first function of a museum object is to exhibit an accurate representation. This presupposes that there is a shared code among those involved in the presentation of the object; that there is in fact a best way to interpret it. A variety of types of information can be transmitted successfully from an object: knowledge about the object; the place of the object in the 'story'; a science concept; and how to look at it. A second function of the object is for it to generate new meaning. It functions as a thinking device. Visitors decode the object differently and independently. The object affords and constrains alternative interpretations. Museum educators have the responsibility to present objects in ways in which their meaning is readily apparent (Rowe, 2002).

Objects can bring about a change in the knowledge and understanding of the learner. They can be revisited, solve problems, and suggest the means by which this might be done. They act as controllers of behaviour, demanding attention and channelling action (McDonald, Le, Higgins & Podmore, 2005). A student's interactions with objects and with others comprise a cognitive system that generates knowledge (McCormick, 1997).

Sandifer (2003) explored the relationship between exhibit characteristics and visitor attention in a science museum. Technological novelty, user centredness, open endedness, and sensory stimulation were shown to contribute to understanding of visitor behaviour, learning, and interactions at exhibits. Concrete exhibits show greater attracting and holding power than abstract exhibits, and

interactive exhibits attract and hold visitor attention for longer periods of time, than noninteractive exhibits. Sandifer's (2003) findings have practical applications for the design of successful exhibitions.

Time

Dierking (2002) refers to a fourth dimension of museum learning – time. A museum visit itself is fleeting and unpredictable. How much learning to expect from a museum visit depends on the visitor, the context, and what happens over time (Rennie & Johnston, 2004). Subsequent reinforcing events and experiences outside the museum are as critical to learning from museums as are events inside the museum. They contribute to what an individual does or does not learn. The knowledge and experience gained from the museum is incomplete, and requires enabling to make relevant and useful (Falk & Dierking, 2000).

All learning takes time. It is not a single event. Visitors learn during a museum visit based on their recollections of previous information, and experiences evoked by the exhibits. For learners to construct new understandings or different ways of thinking requires time for reflection. For a visit to have long term impact time is required to allow learning to find relevance and be transferred from the context of the museum to other contexts (Rennie and Johnston, 2004).

Ultimately museum learning can be viewed as the never ending integration and interaction of three learning contexts personal, sociocultural, and physical, over time, in order to make meaning

2.4.4 Heritage museum as contextualised learning space

Heritage museums are rich resources for learning experiences outside the classroom. They hold historical significance in terms of their buildings, land, genuine artefacts, and collections. They generally hold a museum, archives, historic houses, and gardens. Heritage sites bring to life in an exciting way the stories of real people. They explore culture and identity; routes to the past, present, and future. They draw on material evidence of human lives lived (Commission for Architecture and the Built Environment (CABE) & English Heritage, 2009). Harrison (1970) said that students visiting museums see things remote in time or obscure in purpose. They wander among strange and unfamiliar

objects picturing something of the lives of those who made and used them. Students can discuss how these objects were made, the workmanship, uses, and durability. They can compare things with today and be critical of today.

A learning experience situated in a heritage site provides students with the opportunity to make personal connections with a region and its culture. They share in an economic and social history, and explore change and its influence on the way people do things (Schama, 2009).

Young people identify deeply with where they go to school and live. They are not always able to adequately communicate their sense of place to others. The physical force of neighbourhoods and schools is changing. A learning experience with an emphasis in the local area equips students with the tools to articulate and critically analyse the places where they live and learn, and provide the opportunity for them to understand how a society is shaped by the past (Engaging Places, n.d.).

An authentic learning experience at a heritage site is likely to involve students in experiencing the journey made in the production of a food item; the impact on the environment of different operations and technologies; the diversity of people's roles in society; and in New Zealand, the complexities of immigration and colonisation (MOE, 2008). Such a distinct experience has the potential to stimulate thought, bring academic study to life, challenge perceptions, and encourage students to think in new ways.

2.4.5 LEOTC and technology education

Technology education relates extremely well to the world outside the classroom. It can and does effectively support, enhance, and bring meaning to practical learning. Learning experiences outside the classroom are valuable opportunities for students to appreciate the impact of technology on the made world and how technology influences society. Students can look at how things work, analyse their function, assess their environmental and aesthetic impact, and reflect on and evaluate present and past technological practice. Through examining the uses and effects of technology students develop skills to improve products, generate new ideas and concepts, and become discriminating and informed users of technology.

It is only through an awareness of technology that technological knowledge and concepts can be applied (Breckon, 2001).

McCormick (2004) says that people think about problems in relation to what they are doing in that situation, and the way people think depends on where they are, their 'history' in the situation, the specifics of the context, and the tasks they are doing. It is crucial for technology education that children think through their doing, and for the feedback from this doing, to affect their thinking. For young people to understand the nature of technologies and how they work they must be allowed to participate in technological activity. They need to experience what it is like to engage in authentic meaningful activities that are related to the technological world out of school.

McCormick (2004) too, emphasises the role of context within which technological knowledge is situated. It is necessary to distinguish between particular concepts. In food technology the concepts are different from those found in mechanical engineering. The role of context needs to be seen as part of the knowledge, and this has implications for contextual learning in technology. It is not easy for children to transfer knowledge learned in science for example, across to problem solving in technology.

Rivers (2006) summarised international literature and case studies reviewed during 2004 and 2005 by Moreland, McGee, Jones, Milne, Donaghy, and Miller. Much of the literature researched related to science and informal learning in museums. The researchers' findings describe characteristics and conditions leading to improvements in student learning resulting from effective contextualised learning experiences outside the classroom:

- Linking the school curriculum and the objectives of the visit helps to connect activities more effectively and enhances student learning.
- Learning opportunities are maximised when the teacher is familiar with the site and has a clear purpose and objective for the visit.
- The quality of the collaborative relationship between the teacher and on site education officers and experts supports student learning.

- Student learning is most effective when the teacher prepares the students with pre-visit and post-visit activities that link to the activities provided by the site.
- Student learning is enhanced when educational activities provided at the site are linked to activities done in the classroom.
- Student interest and engagement, arising from a well laid out site and hands-on exhibits enhance the learning experiences.

Learning is not the providential domain of one experience outside the classroom but rather the sum of the activities in and outside the classroom. Students are able to draw connections with their own prior knowledge and see connections with subsequent life experiences. This has the potential to produce rich knowledge and understandings (Anderson, Thomas & Ellenbogen, 2003).

2.4.6 LEOTC and learning history

Museums provide a rich environment for stimulating interest in historical topics and connecting history to the real world. Through oral history, artefacts, visual images, and live actor recreations learning experiences outside the classroom bring to life the social, political, cultural, and economic narration found in text. When the authentic human character is removed, learning in history is reduced to lists, names, places, dates, and facts. These fail to capture the sense of real people, real lives, real times, and real places. Through learning experiences outside the classroom teachers and students acquire the procedural knowledge for historical research, critical thinking and interpreting artefacts (Pershey & Arias, 2000).

Wilson and Hollis (2007) argue that not only are trips outside the classroom important ways in which students learn history; they are important ways in which students become better at history. They demonstrate a model of progression which will ensure that students are properly stretched and engaged by their history trips. Wilson and Hollis (2007) believe trips should do more than put students directly in contact with artefacts and buildings from the past. Further trips provide the opportunity for students to consolidate their understanding and explore in more depth people, places and events. Each trip can have a direct link to, and progress from, previous trips in terms of the skills the students gather as historians. The intention is for students to build up understandings for themselves of how to

interpret a historical site and see it in the context of their immediate studies and a wider understanding over time. The research showed that students' conceptual understanding was refined and their enjoyment and engagement with the subject was enhanced (Wilson & Hollis, 2007).

2.4.7 LEOTC and learning about food

Schank (1995) draws an analogy between learning about food and experiential learning. Schank chooses this domain to discuss because people are somewhat familiar with the domain and it is one for which there do not exist prejudices about what should be known. It would seem rather foolish to teach people how to eat certain foods or how to select food in a restaurant without getting to eat. Someone merely describing how something tastes is not of great value. Learning about food means eating it; thinking about what has been eaten; contrasting one eating experience with another; and asking questions to determine other information that may help make sense of the experience. The implications of this for education suggest that if something is important to be known then a context must be found in which that knowledge matters. Experience is a critical element in understanding what is learned when one learns by doing (Schank, 1995).

Well planned field trips to a grocery store or supermarket can be accessible and engaging experiences to teach about food groups and food choices (Siry & Famiglietti, 2007). Lafferty, Marquart and Reicks (2006) found a supermarket tour was a valuable educational method to help students identify and select whole grain food products. There was an educational component and questionnaire prior to the tour. Students followed a guided tour through the store that included hands on identification of whole grain products and taste testing products. Students had the help of an instructor, were able to share their findings with peers, and have free time finding products. The questionnaire after the field trip showed an improvement in knowledge about whole grains, and students' abilities to identify whole grains.

Siry and Famiglietti (2007) stress the importance of preparing students in advance for a field trip connected to a unit about food. It is important to summarise what has been taught in the classroom, outline the objectives for the trip, and be prepared on the day for the trip. Back in the classroom students reflect on their

own experiences and extend their learning further by researching, preparing and cooking relevant food products. Siry and Famiglietti (2007) say that through such an experience students can connect the information they discover about food to their own lives.

Food as an area of focus is underrepresented in learning experiences outside the classroom but is strong as a curriculum subject. The research of Kendall, Murfield, Dillon and Wilkin (2006) highlights the need for a focus on food and farming as contexts for learning outside the classroom to provide students with the opportunity to see how food is produced.

Research on young people's knowledge and attitudes to a range of topics concerned with food, farming and land management suggest there is a strong case for improving teaching and learning about food. Dillon, Rickinson, Sanders, Teamey and Benefield (2003) researched a large body of literature mainly from the UK and US. Their research found that young people see food and farming issues as less serious than other environmental factors such as the use of additives and pesticides, genetically modified food, ozone depletion, or tropical deforestation. Young peoples' knowledge of how their food is produced and how it gets to their plate however is poor. Students need to reconnect with what they eat and how it is produced. The evidence highlights the potential of out of school learning associated with farms, school gardens, supermarkets, and other field work; where students have the opportunity to access contexts that encourage them to think and learn about the production of food; the origins of food; and the links between the producers and consumers of food through the food chain.

Dillon et al (2003) also provided insight into factors that might impede or facilitate young peoples' learning about food. Young peoples' emotions and attitudes can play an important role in their learning about food topics especially controversial topics such as genetic engineering. Not wishing to touch things, especially objects with dirt and mud, has implications for hand-on experiences on farm and horticultural visits. The impact of a student's cultural identity has to be considered when planning out of school experiences, if learning about food is to be an appropriate and meaningful experience in a multi cultural community. Teaching and learning initiatives need to recognise and acknowledge the

complexity and variability of young peoples' views and understandings in relation to food.

Learning outside the classroom is complex, interrelated and of an evolving nature. The many variables contributing to the experience include the sites selected, the learning activities chosen, the quality of the exhibits and, how students learn and interact (Rivers, 2006).

Having reviewed the relevant research literature that informs this study, the next chapter continues by describing the study's research methodology.

Chapter 3 Research Methodology and Design

There are principles involved in planning and designing a suitable methodology for a research investigation. A systematic approach to the selection of research instruments and data handling techniques is essential (Bell, 1993). This chapter begins by considering the main features of established approaches to educational research methodologies. A section entitled *teacher as researcher* is included to explain the peculiar situation teachers are in when their research project is also their teaching practice. Reassurance is given by describing the expectations for a quality research outcome and by explaining how quality is achieved in this study. The data handling techniques that emerged from the selected methodology are described. With the exception of a focus group interview the data gathering techniques were integrally linked to the classroom activities and assessments. Later in this chapter the research process is described in detail. As the researcher is also a teacher it is appropriate to make links between the research design and formative assessment practices and teaching as enquiry.

3.1 Methodology

Research is a systematic enquiry undertaken to discover new knowledge and understanding of facts and principles. It is necessary for determining how to meet a recognised or specific need. A framework for basic research begins with a question, collects information and establishes facts about an issue, and forms an answer (Cresswell, 2005). Research methodologies describe the different approaches to systematic enquiry. They are characterised by reading and reflection, and specific procedures used to generate and analyse data. Experience and reasoning are combined. Research processes and results remain open to scrutiny and can be revised or discarded (Cohen, et al., 2000).

Research plays an important role in addressing issues in education. Education is complex. Knowledge of the reciprocal interactions between the education process and the pupils, teachers, parents and the wider community is constantly unfolding. Through their enquiry into health, learning styles, remedial interventions, curricula and quality of programmes, educational researchers gain a deeper understanding of problems faced by teachers (Dryden & Vos, 1995). Educational research can address gaps in existing knowledge, extend knowledge to include

new ideas and practices, broaden perspectives by including the ideas of minority groups and suggest improvements to teaching practice (Burns, 2000; Cresswell, 2005).

Approaches to educational research reflect two different conceptions of social reality – an established traditional view and a more recent interpretive view. The established traditional view treats the social world like the natural world. A process of scientific enquiry is applied to establish cause-and-effect relationships between independent and dependent elements. Procedures and methods are designed to discover general laws which explain and govern the reality being observed. The principle concern of the interpretive view of social reality is to understand the ways in which individuals create, modify and interpret the world in which they live. This view emphasises how people differ from inanimate natural phenomena. These two contending approaches to enquiry into issues in schools and classrooms have implications for educational research. Whether a traditional stance or an interpretive stance is taken, influences the whole research process. The construct of research paradigm describes the approach a particular community uses to guide their research; where a set of values and philosophical assumptions are shared. The significance of two world views to educational research underlies the positivist paradigm and interpretive (anti-positivist) paradigm debate (Cohen et al., 2000).

A contemporary view of positivism retains residual associations with natural science. Methodological procedures of natural science are applied to social science. The application of the rigorous, systematic, observational analyses used by natural scientists to social science has grown and advanced knowledge of human behaviour (Best & Kahn, 2006). The social scientist is an observer of social reality. The results of investigations by social scientists are described in terms parallel to natural science – analyses are expressed in law-like generalisations. With positivism, science provides the clearest ideal of knowledge (Cohen et al., 2000).

The application of the positivist paradigm to the study of human behaviour is less successful where the elusive and intangible qualities of social behaviour contrast with the order and regularity of the natural world. The positivist researcher is challenged by problems of teaching and learning, and human interaction in the

classroom and school context (Cohen et al., 2000). The complexity of human nature makes it difficult to develop sound theories of human behaviour. People's feelings, drives and emotions are unique. Human behaviour is influenced by the individual's interactions with the changing environment and the research process itself. Traits such as intelligence, learning, motivation etc are not directly observable. They can only be inferred by test scores or observable acts (Best & Kahn, 2006). The positivist researcher is a detached, objective researcher, concentrating on aspects of the person that exclude the subjective world. Aesthetic, creative, moral, critical and other forms of knowledge are often neglected (Cohen et al., 2000). In the classroom positivist research can be seen when teachers and learners are observed doing certain activities. What they do is analysed and reported. The teacher's role is as a consumer of the research and is distanced from where and when it is reported.

The interpretive paradigm places the researcher at the centre of the enquiry. The researcher begins with the individuals and sets out to understand their interpretations of the world around them. Theory emerges from the data generated by the enquiry. The social world can only be understood from the perspective of the people being investigated. Individuals are part of the action. They share a frame of reference with the researcher, both gaining new insights. The interpretive researcher addresses important aspects of human behaviour that cannot be directly observed such as intentions and feelings (Cohen et al., 2000).

Interpretive research is characterised by a combination of interviewing and observations of participants in natural settings, where culture, meanings and processes are emphasised. People actively construct their world. They make meanings through activity. Meanings are influenced by changing contexts. People are unique and not generalisable. Multiple interpretations and perspectives are gained from single situations. The risks of the interpretive approach to research are that an artificial boundary surrounds the enquiry and the results become sealed from the world outside the participant's domain of activity (Cohen et al., 2000,). Interpretive research in the classroom is an account of a classroom experience. It is usually in the form of a narrative, which includes the teacher's own feelings and intentions as well as what took place as they saw it. Other insights may be included such as examples of students' work or comments by students.

Burns (2000) describes two competing research methods that researchers engage - the quantitative, traditional, scientific method and the qualitative, naturalistic approach. The quantitative approach produces findings arrived at by means of statistical method. Quantitative methods, particularly in science research, use the discreet and distinct steps used when conducting an experiment. It produces data that can be statistically analysed, for example an IQ test. Results are usually expressed numerically and seek explanations for cause and effect relationships.

The strengths of quantitative methods include precision and control through sampling and experimental design. Data is more reliable than common sense, intuition or opinion. The limitation of quantitative research is its failure to take account of people's unique ability to interpret their experiences, and construct their own meanings and act on them. It leads to the assumption that facts are true and the same for all people all of the time (Burns, 2000). To be faithful to what is really going on in education the quantitative researcher's press for clarity can come at the expense of accuracy (Labaree, 2003).

A qualitative method gathers data in non numeric form such as a transcript of an interview. It captures what people say and do as a product of how they interpret the complexity of their world. It is difficult to apply conventional standards of reliability and validity to qualitative data. Its subjective nature and origin in single contexts means that research cannot be replicated or generalised to a wider context with confidence. Data collection, analysis and interpretation take longer. Qualitative research, with a focus more on description and interpretation than on causation, is well suited to the task of understanding education. Strengths of qualitative data collection, particularly in education, are its close association with the participants and the opportunity to report teacher interpretations and teaching styles (Burns, 2000).

To a certain extent all research methods deal with qualities. Observed qualities are counted. Methods of analysis use some form of number such as tend, most, some, all, none, few, etc. Patterns in qualitative analysis are based on these words. Uniqueness is a numeric description. Words can be counted and numbers can be descriptive. The quantitative approach can never be totally objective since subjectivity is involved in the choice of the research question and the interpretation of results (Gorard, 2006).

The character of education makes research particularly difficult. Labaree (2003) describes the special nature of knowledge that educational researchers are asked to produce. Making sense of teaching and learning within a large complex organisation such as a school does not necessarily establish reliable and valid claims that can be extended beyond the particular time and persons under investigation. The contrasting goals of teaching and research have lead to multiple methods of enquiry for educational research – research that focuses on description and interpretation rather than causation.

Johnson and Onwuegbuzie (2004) position mixed method research as the natural complement to traditional quantitative and qualitative research. A mixed method approach draws from the strengths, and minimizes the weaknesses in both. Both use empirical observations to address research questions; describe data; construct explanatory arguments from data; speculate about why observed outcomes happen as they did; incorporate safeguards to minimise bias; and are trustworthy. Research is more effective, and greater confidence can be held in conclusions, when findings are corroborated across different approaches. For education, the eclectic nature of a mixed method of enquiry fitting together insights from quantitative and qualitative methodologies, will address the social and material realities initiating research.

Qualitative and interpretative research techniques are the major approaches taken in this research. Insights from quantitative research techniques, though minor in relation to the primary instrument, do contribute to the multiple methods of gathering data and thus the reliability of the findings.

3.2 Researcher as teacher

The aim of this research was to explore secondary school students' understanding of the relationship between the development of food technologies and society. This research was carried out in the natural setting of a school. I was in the dual roles of researcher and classroom teacher.

Labaree (2003) discusses the difficulties of turning educational practitioners into educational researchers. Differences in world view between teachers and researchers cannot be eliminated easily because they arise from irreducible differences in the nature of the work that teachers and researchers do.

Labaree (2003) describes the transition from teacher to researcher as natural. Teachers bring maturity to their role as researchers. They are adults who have or have had a career and professional experience in teaching. They have a sense of what is happening in the institution they are investigating. They are committed to education, certain that the future of the country and its children depends on the quality of teaching and learning.

A difference in world view derives from the nature of teaching as a practice and the nature of research as a practice. The conflicting cultures of practice in teaching and research asks teachers who become researchers to transform their orientation from putting a premium on doing what is best for the student to analysing, clarifying and validating the causes and consequences of educational practice. As researchers, teachers focus their attention on what is going on and why, instead of focussing on what to do and how to do it. Teaching takes into account the special learning needs of individual students. Research entails the development of generalities that apply to more than one student, class, or school. Researchers learn about education by examining it as an outsider. Teachers find theory as useful as experience (Labaree, 2003).

One way to deal with the researcher/teacher divide is to acknowledge it and sell the value of adopting the researcher perspective as an addition to, rather than a replacement for the teacher perspective. Both: – accept moral responsibility for the consequences of education; develop close personal relationships with students and subject; balance the urge to generalise against the need to validate generalisations about social phenomenon specific to time, place and person; and build on their own experiences which exert a powerful impact on the kind of work they pursue. Research draws heavily on knowledge and practice of teaching – teachers need to acquire skill in and respect for analytical, intellectual, theoretical, and universalistic orientations of the researcher (Labaree, 2003). Bell and Cowie (1999) talk about the research process as having reciprocal purposes for both teachers and researchers. Researchers extend their knowledge about classroom practices, while teachers see their involvement as participants in research as an important professional development opportunity.

As a teacher researcher I had an obligation to use the power of research responsibly. Being an educational researcher requires careful preparation and

implementation of the research process. Commendable researchers understand their strengths and weaknesses and are clear about their own research position. They acquire knowledge of current research methods and consider quality, ethics, validity and reliability in the planning and process of their research. They minimise bias in their research by acknowledging, respecting and reporting from the world view of their participants. Teachers who accept a role as researcher in the classroom appreciate the reciprocal partnership that develops as teachers develop educational theory and researchers see classroom practice from a new perspective.

Formative assessment

As well as contributing to the research, testing and examining students' portfolios are both aspects of formative assessment that teachers are expected to undertake in a natural classroom environment. Formative assessment is the process by which teachers gather assessment information about their students' learning and then respond to promote further learning. Students find out about their learning and teachers find out about the effectiveness of the learning activities they are providing. The feedback or dialogue is an essential component of formative assessment interaction where the intention is to support further learning (Bell & Cowie, 1999).

Clarke (2005) says formative assessment makes a significant difference to students' progress. It impacts on their ability to be confident, critical learners. A characteristic of a constructivist classroom includes formative assessment techniques. Teachers enquire about students' understandings of concepts before sharing their own understandings. Formative assessment provides students with opportunities to make improvements on their work. The ongoing oral and/or written feedback is a valuable formative assessment tool for technology teachers guiding students assembling portfolios of their technological practice.

Teaching as enquiry

The most recent curriculum document (MOE, 2007) says that effective pedagogy requires that teachers enquire into the impact of their teaching on their students. Food technology teachers are aware of successful learning outcomes that arise for their students from integrating practical activities with theory inside the classroom

(Jones, 1997). A learning experience outside the classroom for a group of food technology students is an opportunity to explore the teaching-learning relationship in a new context. In this research the students were invited to express their opinions regarding the value of a learning experience outside the classroom for their learning in food technology. In this sense this research had the potential to solicit responses to queries such as what happened as a result of the learning activity; what strategies helped the students learn; and what are the implications for the future (MOE, 2007). The responses to the over arching research question for this study: What are the benefits of taking secondary school food technology students on an interactive learning experience through a live historical village, can address the questions teachers are invited to ask themselves when enquiring into the impact of their teaching on student learning outcomes.

3.3 Quality attributes of the research

Lauer (2006) outlines how educational research is assessed for relevance. The researcher is responsible for the quality, coherence, applicability, and educational significance of the research. For validity the study must connect to and contribute to current knowledge; the research process must follow accepted techniques; conclusions must be trustworthy; and established ethical guidelines must be followed.

There are attendant moral issues implicit in all research undertakings. All parties involved in the research process and using the findings have a right to expect that the research be conducted rigorously, scrupulously and in an ethically defensible manner. The consequences of the research and issues of sampling, reliability and validity need to be considered from the outset. Researchers need to meet their obligations with respect to the research question, the methodologies and the participants involved in, or affected by, their investigations. Ethical concerns in educational research can be complex. Researchers have to strike a balance between meeting their responsibilities as professionals in pursuit of truth, and protecting the rights and values of the participants (Cohen, et al., 2000).

The ethical concerns addressed in this research included obtaining informed consent from the student participants; monitoring potential harm throughout the project; and the ongoing maintenance of confidentiality with respect to data. To

protect and respect the rights of the participants the researcher consulted with and sought permission from the students and the adults responsible for the students. The students were sufficiently mature to understand the investigation so that they could withdraw without question (Cohen, et al., 2000).

Successful research lies in establishing good relationships with the participants. The researcher has privileged access to private information. Any sensitive or contentious issues that arise during the process are resolved more easily when there is confidence and trust between the researcher and the participants. Where researchers' professional behaviour is guided by a code of practice, researchers approach the process with greater awareness and fuller understanding of ethical issues in the process, particularly their responsibilities to the participants (Cohen, et al., 2000). Most professional organisations have established ethical guidelines. Prior to embarking on this research project a detailed application was made to and approved by an ethics committee of the University of Waikato (Appendix A).

As well as the participant students and the two other class teachers the research project required acceptance from the school's Board of Trustees and Principal (Appendix B). At the outset the researcher presented the school with the topic; the research design; a guarantee of confidentiality; and the proposed data analysis techniques and dissemination of findings.

The researcher attends to validity and reliability throughout the research process for both quantitative and qualitative methods. In qualitative data validity is addressed through the honesty, depth, richness and scope of the data achieved; the participants approached; the extent of triangulation; and the disinterestedness or objectivity of the researcher. A degree of bias enters qualitative research through the subjectivity of the respondents – their opinions, attitudes and perspectives. In quantitative data validity is improved through careful sampling; appropriate instrumentation; and appropriate statistical treatments of the data. Quantitative research possesses a measure of standard error which has to be acknowledged (Cohen, et al., 2000).

Reliability of research is concerned with precision and accuracy. The characteristics of reliability in qualitative research are the fit between what a researcher records as data and what actually occurs in the natural setting that is

being researched; the degree of authenticity and comprehension; fidelity to real life; detail; honesty; depth of response; and meaningfulness to the respondents (Cohen et al., 2000).

Triangulation is a useful research tool for validating complex and controversial topics. Cohen et al. (2000) describe triangulation as attempts to explain more fully the richness and complexity of human behaviour by studying it from more than one standpoint. It is associated with the practice of drawing on a variety of data sources which are cross checked with one another to limit bias. Triangulation in this research was achieved through using different methods on the same object of study and using both qualitative and quantitative data collection methods.

3.4 Data handling

Classification, sorting and tabulation of data are important parts of the research process. The researcher must guard against the limitations and sources of error inherent in the processes of analysis and interpretation of data. Problems that can arise include individuals making statements that are not necessarily true; formulation of generalisations that are not warranted by the data collected; careless data entry; invalid assumptions; inappropriate analogies; and the researcher's unconscious bias. Good researchers maintain objectivity by being aware of their own feelings and areas of bias. Few individuals achieve complete objectivity. They may omit evidence unfavourable to the hypothesis or over emphasise favourable data in their report (Best & Kahn, 2006).

In this research multiple kinds of data and multiple ways of collecting data were used to increase the validity of the data collected and the data analysis. The research design brought together broadly compatible techniques from qualitative and quantitative methods. It went beyond a single approach to data collection and supplemented a primary information source with other complimentary methods. A focus group interview was selected as a prime data source. Multiple kinds of data from the classrooms in action supplemented the focus group interview. Classroom data were in the forms of a unit pre-test and post-test; information embedded in portfolios of students' technological practice; participant observations during a field trip outside the classroom; and informal discussions with participants and their teachers in the classroom.

3.5 Research questions

The technology curriculum asks that students develop a sound understanding of the nature of technology. Through their exploration of the characteristics of technology and technological outcomes students are expected to develop an understanding of technology as a socially embedded human activity positioned within a particular time, and physical and social location; as well as a philosophical understanding of the intentional process of the design, decision making, processing, manufacturing, construction, and evaluation of the resulting outcomes of technological development (MOE, 2007).

The Nature of Technology strand of the curriculum defined in a food context, and easy access to a live historical village, plus achievement standard assessment opportunities, provided favourable circumstances for developing an interesting unit of work for year 11 food technology students. This cluster of circumstances provided this teacher with a topic having research potential around a strand of the technology curriculum, and provided the added value of exploring students' experiences outside the classroom.

The research questions developed were:

- What are the benefits of taking secondary school food technology students on an interactive learning experience through a live historical village?
- How does this experience help students understand the development of food technologies?
- How does this experience help students appreciate the complex interface between food technologies and society?

3.6 Data gathering techniques

The teaching plan for a baking unit delivered to year 11 food technology students informed the range of data gathering techniques applied to address the research questions. A key teaching strategy embedded in the baking unit was a planned learning experience at a historical village on a live day. A focus group was planned as a prime research method purposefully designed to find out from the students benefits to their learning about food and food technologies from participating in a field trip. Other instruments used to gather data included tests, document analyses and feedback from students and teachers.

3.6.1 Focus group interviewing

Focus group interviewing is a research technique commonly associated with educational research. Focus group research attempts to collect the thoughts of people brought together to discuss a specific topic. Success of the group interview relies on interactions within the group who discuss the particular topic supplied by the researcher. Participants interact with each other rather than the interviewer. Participants build on each other's responses. Data emerges from the interactions of the participants as they discuss their views on the given topic (Cohen et al, 2000). Allowing participants to talk about what is of central significance to them rather than to the interviewer is important (Bell, 1993). Lauer (2006) cautions that adequately and accurately capturing discussion in this way is not a simple matter. The interviewer needs skill to ask questions and probe at the right time while allowing discussion to flow without interruption (Bell, 1993).

The contrived nature of a focus group setting – bringing together people from a particular age cohort (Grix, 2004) – to discuss a given theme is both their strength and their weakness. They are unnatural settings yet focussed on a particular issue and therefore will yield insights that might not otherwise have been available in a one on one traditional interview (Cohen et al, 2000). Establishing a structure for the focus group interview process ensures that the topics crucial to the study are covered; eliminates some of the problems of a completely unstructured interview; and simplifies the analysis of the data (Bell, 1993).

A focus group interview can have limitations. Participants must be willing to interact and share their perspectives. Effective facilitation takes practice and the facilitator needs to be aware that her own behaviour and attitudes can affect group dynamics and consequently the results. Interviewer bias is inherent as the researcher does not consider or ask all the possible questions. There may be a tendency to over qualify results.

The focus group interview was selected as the prime instrument for gathering data in this study because it provided the opportunity to explore the student participants' views in depth. The focus group interview was the only part of the research that was not an integral part of the everyday classroom activities planned for all the year 11 food technology students and the unit on baking. Strengths of

the focus group research were asking students about their firsthand experiences and perceptions visiting the historical village; asking them what they did and how they felt. The focus group interview encouraged mutual interaction and 'off the cuff' perspectives from the students. It had practical benefits too being relatively easy to organise, inexpensive, and provided a fast turnaround for generating results.

The criteria for selecting the students for the focus group were for each of the three class teachers to invite three students whom they thought would be comfortable and confident participating in the activity. Eight students accepted the invitation and were present for the occasion. The students knew each other but not necessarily very well. To establish a comfortable, informal and positive environment I provided refreshments for the students at the start. I wanted the students to be relaxed and enjoy the experience. The video and audio back up technologies used for recording the focus group were done by a third party impartial technician so that technical issues did not interrupt the interview process. Having the video record provided the opportunity to capture the body language and emotional content of what was said by the participants.

There was an established structure for this focus group. The interview began with an explicit explanation of the ground rules. It was explained to the students that their identity would not be revealed and that the information they provided would be kept confidential. Pseudonyms would be used in reporting. Students were told how the data was to be used. The questioning followed a prepared guide. The focus group lasted an hour. The record of the group's discussion became the data. This was later transcribed and used to better understand and interpret the issue.

An interview means questions are involved. Fowler (1998) outlines some general rules for designing survey instruments and these were applied to the questions for this focus group interview. A list of general questions, focussed on first impressions of the visit to the historical village, was used to generate discussion. The wording and vocabulary of all the questions were appropriate for the student participants so that they understood and made sense of the question. Each participant was given an opportunity to be heard.

The focus group was only one part of this research process. It was complimented with other techniques that could provide data not accessible from a focus group discussion (Fowler, 1998).

3.6.2 Tests

In tests researchers have at their disposal a powerful method of data collection of a numerical kind. Tests are designed for a specific population such as a class in school. Their attractions are utility for small samples and tailoring to individual circumstances. Tests are stock-in-trade of classroom teachers as home designed questionnaires, frequently administered at the end of a curriculum topic or unit. They offer teachers valuable opportunities for quick, relevant and focused feedback on student performance. The post-test only design can be limited in scope and its validity and statistical power is weaker than a pre-test post-test design. The pre-test post-test design is the teacher's preferred method used to measure the degree of change occurring as a result of an intervention. When monitoring the effect of a new teaching method upon a group of school children a pre-test at the beginning ensures the group is equivalent. Teachers and researchers can only assess how much an educational experience has added value to students when the students' starting points are known (Cohen et al, 2000).

This research study used a pre-test post-test design as one of several instruments at the researcher's disposal to determine the effects of a field trip outside the classroom upon students' understanding of the nature of the reciprocal relationship between changes in society and the history and development of food technologies. The pre-test was a diagnostic test, which discovered the students' knowledge and understandings about the development of specific foods and food technologies, prior to the commencement of the teaching unit. It gave the researcher and the two other classroom teachers a more accurate insight into students prior knowledge before the field trip to the historical village. The students' achievement on the pre-test determined which specific content areas needed to be addressed through teaching. Pre-test analysis gave the teachers starting points for conversations with students as they walked around the village. Teachers had realistic ideas of what the students didn't know which prompted targeted questions from them to the village volunteers; obvious questions so the students could hear the volunteers' answers. This let the volunteers know what the

students didn't know. The students were more confident asking the volunteers basic questions such as where does milk come from.

The post-test measured the value added component of the teaching and learning and was administered after the field trip to the historical village. The quantitative data gathered contributed to the mixed method approach, though minor in this study overall, was useful for the research and the teaching. Data was gathered from the pre-test and post-test responses. Quantitative data from the two tests also gave the teachers useful information regarding the test questions, the test format, and the length of the test.

The content and level of difficulty of the pre-test and the post-test were the same though there were differences in the wording of some questions. An assessment schedule was developed for each test and this was closely followed by the three classroom teachers. The researcher transferred the test data from the student participants' test responses onto excel spreadsheets. The students were not identifiable on the spreadsheets as pseudonyms were applied.

3.6.3 Documentary evidence

In the context of this research, documentary evidence refers to information that is significant to the research questions, found embedded in the portfolios of the students' technological practice. The portfolios are written with the purpose (Grix, 2004) of providing evidence for assessment against achievement standards in technology and are presented in a manner that provides the opportunity for students to meet the assessment criteria for more than one achievement standard. One of the three achievement standards that comprised the portfolio was externally assessed. The evidence for this standard though integrated into students' technological practice was presented as a standalone assignment.

Examining the students' portfolios during and at the end of the unit enabled the researcher to identify material that contributed to the research objectives. Data from the portfolios might include evidence that students' design ideas were informed by the historical and cultural activities in which the students were involved; evidence that students used understandings about food ingredients, baking techniques and technologies in the design of their individualised food product; evidence that students identified the historic village visit as a milestone

stage in their planning; evidence that village personnel were identified as stakeholders; and/or evidence that students explained how experiences from the past impact on how things are done to today and in the future (MOE, 2007). Data arising from the field trip and documented in the portfolios, could also include perceptions and experiences with past technological developments and their impacts on current and future technological developments (MOE), 2007). The quantitative data that emerged and was sighted in the portfolios was related to the numbers of students who made one or more of the possible links indicated above, between the field trip and their technological practice.

Material sighted in portfolios that was relevant to the research objectives was photographed or photocopied and printed. Pseudonyms were applied to the individual student's data and names were not recorded.

Documentary evidence in this research supplemented the information obtained by the tests and the focus group. Bell (1993) describes documentary evidence as a valuable source of data for research as it is genuine documentation developed during the period of the research. It is the researcher's responsibility to assess its precise significance.

3.6.4 Discussions

Discussions in this research refer to two post field trip occasions when verbal and written feedback was sought from the students. Seeking feedback from students regarding their impressions and opinions about classroom activities is frequently verbal (Lauer, 2006). In these two instances specific open ended questions were asked and after whole class discussion students were invited to note down responses at the request of the researcher. Students understood that they were free to contribute or not.

The questions asked were in the form of two short surveys. This data gathering was on a small scale basis. The aim was to explore students' highlights and impressions of the field trip generally; how students thought participating on a field trip was a good way to learn; and how they felt the field trip helped them with their assignments. Surveys are widely used in educational research, particularly smaller scale descriptive research. They invite honest personal

comments and put the responsibility for and ownership of the data firmly in the respondents' hands (Cohen et al, 2000; Lauer, 2006).

3.6.5 Interviews

There were three year 11 classes involved in this research project and each class had a different teacher. The interest and cooperation from teaching colleagues was an essential and invaluable asset in view of the fact that the researcher was asking for access to their students to support the research. At the end of the process, teaching and assessing the baking unit, I audio recorded a short interview with the two other year 11 food technology teachers. The teachers gave informed consent and confidentiality was assured.

In a successful interview an interviewee and respondent gather and exchange pertinent information in a purposeful way. It is more than a conversation in that it is planned, prearranged, and has a pre-determined purpose (Dwyer, 2000). The goal of this interview was not to simply collect data but for the three teachers to discuss interpretations and exchange views about the field trip (Cohen et al, 2000).

The style of the interview chosen was in the form of a short unstructured conversation. The conversation included talk about reactions and feelings. The quality of the data resulting from this conversation was likely to be significant because of the naturally positive degree of engagement amongst the three teachers (Burns, 2000; Grix, 2004).

Question design has been discussed earlier specifically in relation to the focus group. Interviews and discussions too usually involve questions. The questioning techniques used for these latter two data collection methods were open. Open questions encourage interviewees to speak freely and are designed to allow for expressions of opinion and explanations of events. In research simple descriptive questions that are clear, unambiguous, and easy to understand are effective in conjunction with other data collection methods (Grix, 2004).

3.7 The research process

The aim of this research was to appraise the benefits of taking secondary school food technology students on an interactive learning experience through a live

historical village. The research specifically enquired into how a learning experience outside the classroom helped students understand the development of food technologies, and how a learning experience outside the classroom helped students appreciate the two way relationship between the development of food technologies and changes in society. Described here is the catalyst for this research, the context in which the research took place, and an outline of the research processes undertaken.

Setting

This research project was stimulated by an interest and enjoyment in visiting live historical villages overseas; and visiting the local historical village that is the subject of this enquiry. My impressions after first visiting The Historical Village were that it had a lot to say about developments in food technology and therefore had potential as a resource for the secondary school food technology students I was teaching. The Historical Village, as has already been mentioned earlier in this thesis, represents the period in New Zealand history 1840 to 1880 which is the period when the Fencible immigration scheme gave defence to Auckland and men who would ultimately become landed settlers (La Roche, 1991). Food and food technology exhibits are varied and plentiful in this village and encompass a wider period in history with relation to cooking food than the 40 year period represented by the village. The historical reasons for this are explained by the fact that the Fencible families began their lives in New Zealand with access to very little in the way of cooking resources and only accessed more sophisticated cooking technologies as they became available. For educational purposes this village focuses on meeting the needs of primary school visitors and exposes these children to many aspects of life from this period not just food preparation.

In several ways the first visit to the village accompanied by secondary school children was a test case both for the secondary school teachers involved, and the village staff and volunteer guides. As the village rarely hosted secondary school students from the technology learning area it was expedient to reassure the village personnel about the usefulness of a visit for year 11 food technology classes. A specific programme that focussed on the development of food technologies was negotiated with the education department staff of the village. The success of the first visit, indicated by the positive feedback from these earlier students, resulted

in the visit being embedded into the year 11 food technology programme in the following year. What had developed into an annual field trip came to be the research opportunity. What were the elements of the earlier field trips that contributed to their success? The research questions for this thesis evolved from the links that the earlier students made between the field trip and their technological practice. These links were seen in predictable classroom strategies such as assignments, portfolios and post-tests. These classroom techniques were also included amongst the data collection methods utilised for the field trip that was the focus of this study.

Participants

The participants in this research were secondary school students in a New Zealand co-educational state school. All the participants had selected year 11 food technology as a level 1 NCEA technology subject. In the year in which the study took place there were three classes of students. All the students were invited to participate in the research. The classes were randomly constituted academically and had a balance of female and male students. Each class had a different food technology teacher.

The year 11 food technology students were involved in preparing a portfolio for assessment against two level 1 NCEA internally assessed technology achievement standards, and one level 1 NCEA externally assessed achievement standard. The brief for the technology programme was concerned with developing a baked, snack food product for an identified, adolescent, target market. The teaching and learning activities at the heart of this research were directly related to one external achievement standard: *Describe the interactions between a technological innovation and society.* A class field trip to a historical village on a live day provided a rich context for the students/participants to develop material for the external assessment; as well as playing a significant part in contributing material to the research. Other classroom experiences in which the research participants were involved included a pre-test and a post-test; independent research; foods practical activities; observations; and discussions. Part of the evidence, contributing to the research objectives, was embedded in the students' portfolios; the record of the students' technological practice.

The first task for this research was to complete the ethics approval process as per The University of Waikato schedule. An important aspect of the approval process was to formally advise all the students about their potential role in the research and invite them to participate or not, as they and their caregivers wished. For convenience the letter of explanation about the research and the letter of explanation about the field trip were given out at the same time. The three class teachers involved collected the students' permission slips. At the end of this administrative process 62 students who joined in the field trip also expressed a willingness to participate in the research.

Unit of work

A learning experience outside the classroom was the focal point of this research. A planned field trip was embedded into a unit of work on baking. Students were given a brief that involved developing a baked lunch box snack food suitable for an identified adolescent market. A trip to a historical village that displayed basic baking ingredients and early baking technologies was an appropriate backdrop for this brief.

Ultimately the students were asked to present a portfolio of their technological practice for assessment against two internal achievements standards and one external achievement standard. The externally assessed achievement standard that specifically stimulated the interest in the field trip and subsequently this research was *Describe the interactions between a technological innovation and society.* This achievement standard involved identifying key technological advance(s) underpinning an identified technological innovation; describing how societal factors have impacted on the technological innovation; and describing the impact of the technological innovation on society (MOE, 2009).

Whereas the class work was delivered seamlessly across the three achievement standards the externally assessed standard was presented as a standalone assignment. The teachers had to take into account assessment presentation criteria set out in the standards specifications handed down from the New Zealand Qualifications Authority (NZQA). The final version of the assignment was not due to be handed in until the beginning of November; in time to meet NZQA deadlines for external marking. From the start of the unit the students were made

aware of two deadlines. The first deadline set was for students to prepare a draft of the assignment and to hand that in to their teacher a week after the first school holiday break which was six weeks after the field trip. There were formative assessment opportunities and time for students to revise their drafts before the first deadline. After this date the assignments were set aside to be revisited and added to at the beginning of the fourth term. An important component of the assignment was for the students to show how the technological innovation researched linked to their technological practice. This could only be done after the completion of the two internal achievement standards which was at the end of October.

3.8 The learning experience outside the classroom

The field trip that was related to this research took place in the middle of March. A date early in the year was selected because the climatic conditions moving around outside the village would be more comfortable at that time of the year; and the students' experiences at the historical village could enhance their technological practice as they worked towards completing the internal achievement standards. Students had an opportunity to provide evidence in their portfolios (Appendix C) of links between their experiences at the village and one or more of the components of technological practice – planning, brief development, outcome development and evaluation (MOE, 2007).

Milne (2005) describes three components of a successful field trip: the planning and preparation for the visit; the management of the visit itself; and the follow up activities after the visit.

3.8.1 Planning and preparation for the visit

From a local curriculum perspective it was necessary for the year 11 food technology teachers to plan how the visit to The Historical Village was to fit into a technology unit centred on baking. As the activities at the village included butter making and cooking demonstrations over an open fire there was a natural link between the exhibits at the village and the existing baking unit.

The teachers allowed three to four hours of classroom activities before the field trip. This time was spent preparing the students for the visit; explaining the purposes of the visit, including how the visit linked to their technological practice designing and making a baked snack food product.

The first classroom activity that the students were involved with that provided data for the research was a pre-test. The purpose of the pre test was to identify the students' prior knowledge of the topics. There were questions on the pre-test designed to find out what the students already knew about the origins of food and food technologies. The plan for the visit activities that the students were to be involved with informed the design of the pre-test; therefore there were questions relating to cooking, cooking technologies, and butter. There was time after the pre-test for clarification and review of the questions and students' responses.

Some of this class time was spent reading and discussing the features and historical significance of the village, and village life during the period 1840 to 1880. The village education department had forwarded to the school some material prepared for students and teachers to use with field trips. The village website and the Fencibles website, also both provided information. Students were introduced to the ingredients and processes which they would encounter during the visit. Teachers held back on some food processing and cooking details in order that the students had an opportunity to experience a 'wow' factor during the visit itself. I wanted the students to have the opportunity to experience surprise and wonder as they learned about food production and the development of food technologies for the first time.

The Historical Village remained open to the public during the visit. It is a popular tourist destination. This also was explained to the students and they were asked to be mindful of general guidelines round courtesy and citizenship while sharing the site with others (Milne, 2005).

All three teachers were familiar with the village prior to the trip that is the focus of this study. Collaborating with the education department personnel at The Historical Village where the field trip took place was a particularly important part of the preparation for the visit. The Historical Village did not usually focus on presenting one technological area and did not often entertain secondary school students. For these reasons explaining what was needed from them for our students had to be made clear. The education department staff and volunteer guides were enthusiastic about the visit and an interesting programme for the day unfolded quickly.

The food technology processes and innovations the students were able to see traced over time at The Historical Village were butter making; cooking particularly baking; and associated cooking technologies particularly ovens.

Live days at this village usually consisted of food and cooking demonstrations for visitors and did not include preparing food for visitors to eat. The class teachers believed that it was important for the students to have the opportunity to eat any food that they had prepared. Therefore the food technology department at the school arranged with the village staff beforehand to provide enough food resources for the cooking demonstrations and for the students to consume. This enabled the village volunteers and staff to focus on maintaining the fires. The students and the food technology teachers were assured knowing that there were sufficient food resources for all the students for the duration of the trip – more than four hours.

The specific food product that the students participated in preparing from scratch whilst on the field trip was butter. There were three other food products prepared or cooked during the visit. These were lemonade made from real lemons; ginger biscuits and small loaves of bread. The latter two baked products were pre-prepared at school, transported to the site, and cooked on older cooking technologies located in different parts of the village. The biscuits were cooked on a griddle over a hearth inside a small Fencible cottage and the loaves of bread were baked in a cast iron wood burning stove in an early homestead.

3.8.2 Management of the visit

At the village the students were asked to form themselves into three groups of similar size. A food technology teacher accompanied each group. For this trip the students were asked to wear mufti including sensible walking shoes. It was important for the students to immerse themselves in a historical experience with few constraints or reminders of a more modern era. Primary school visitors to this site are encouraged to dress in period costume. Capturing the village ambience was an important notion shared with us by the village education department. Related to this also, the students were not asked to complete written answers to question sheets as they explored the village environs. Another important aspect of the visit was for the students to be open to everything that was going on and completing worksheets was a potential distraction.

During the exploration of the village there were three main activities for the students to focus their attention: butter making, baking biscuits on a griddle over a hearth in a small cottage and baking bread loaves in a wood burning stove. The students did not necessarily experience each activity in the order in which the technology developed. Some volunteers did not move around the village with the students but stayed with their specialist activity. There were other volunteers moving around the village outside and they guided the students when required. The three teachers were familiar with the layout and functions within the village and were also able to describe and explain the different features as well as answer any questions from the students. Between activities and after the last activity students had free time to wander around the village independently. The teachers mingled with the students at these times. There were several static displays that were related to food and food technology scattered around the village and it was part of the learning experience to draw attention to these. The static displays included a general store; community bread baking oven; water well; flour mill with a working water wheel, grinding stones, sieves and C19th packaging; as well as pioneer varieties of vegetable plants and fruit trees. As the students moved from area to area they were able to see the progression of living conditions experienced by the Fencible families over the forty year period. The progression was from tent to raupo hut, and then to different sized cottages. Each home displayed included the cooking technology that would have been used from the open fire outside, through simple hearths inside to more sophisticated fire places, and lastly the New Zealand made Orion wood burning range in what was called the 'big house'. This was a double storied villa with a fully equipped dining room, kitchen and larder where a financially successful family in the community at that time might have dwelled.

3.8.3 Follow up activities after the visit

Frequent references to the exhibits accessed during the field trip were made during classes over the following lessons. Follow up lessons in the classroom immediately after the field trip recapped aspects of the material covered during the village experience. The teachers addressed remaining gaps in knowledge identified by the pre-test and answered questions arising from the field trip. The students made butter from cream in a jar and used this in a baked product. Students looked at photographs of the resources at the village. Some students had

taken photographs of their own and shared these with their peers. There was a classroom activity organised around the free standing stoves used in the food technology class rooms. It was important for all the students, including those that were not able to participate in the field trip, to have sufficient information and experiences with the foods and cooking technologies to be in a strong position to select a technological innovation to discuss in the forth coming written assignment. The assignment details were reiterated to the students and the due date for the first draft was set. Time for independent individual research was allowed and electronic and hard copies of supplementary resources were made available. After the drafts were received from the students the post-test and post field trip discussions took place.

The post-test was not exactly the same as the pre-test. Feedback from the pre-test had suggested that it was too long. Some students left gaps in the pre-test, though there was sufficient time allowed, so some questions in the post-test were altered and shortened to make the test more straightforward for students to complete. As with the pre-test the post-test asked questions relating to cooking, cooking technologies, butter and impacts on society. The researcher recorded pre-test and post-test data and this data was used to support the findings described in chapter four.

Focus group

The focus group interview presented the opportunity to access a large amount of data economically and triangulate with the other data collection techniques (Cohen, et al., 2000), as well as capture the body language and emotional content of what was said by the participants.

The focus group was held two months after the field trip and approximately two weeks after the first drafts of the assignments were completed. Nine students were invited to join the focus group, three from each class. The class teachers issued the invitations. Eight students accepted the invitation and obtained parental permission to participate. The information provided by the focus group participants was kept confidential. At the beginning of the interview participants were promised that their identity would not be revealed and where appropriate pseudonyms would be used in reporting.

An interview guide was prepared for the focus group (Appendix D). There were general questions asking the students about their impressions of the field trip and specific questions asking students about butter, cooking technologies and interactions between these technological innovations and society. After the session the data was transcribed and used to support the research findings which are described in the next chapter.

Discussion

Whole class discussions between students and their class teacher were facilitated on two separate occasions after the field trip. The format for the first feedback opportunity was for each teacher to invite the students in her class to talk about highlights of the field trip generally and then to ask the students whether going on a food technology field trip was a good way to learn about food, food production, and food technologies. After the discussion research participants were invited to note their responses and opinions down on a specially designed brief, survey form (Appendix E).

The format for the second class discussion was very similar. This feedback opportunity happened a few months later in the year, just after the assignments were completed and handed in. The questions the students were invited to discuss were concerned with how the field trip earlier in the year helped them with their assignment; and how the field trip helped them understand the two way relationship between the development of food technologies and changes in society. It was explained to the student participants that contributing to the written surveys was optional and specifically for the benefit of the research (Appendix F).

Feedback is an important part of technological practice. An assignment (Appendix G) drafted in the early part of the school year with a final due date at the end of the year provided students and teachers with ample formative assessment opportunities. It also kept the learning experience outside the classroom at the forefront over the time that the students were undertaking their design brief. As well as the two formal feedback occasions described here that contributed to the data gathering, there were other times during lessons when teachers and students reflected on The Historical Village experience.

Teacher interview

Informally speaking to the food technology teachers who accompanied the students to the Historical Village provided an opportunity to hear their perceptions of the field trip experience. This interview took place after all assessments for the year 11 classes were finished. The interview was audio recorded with the teachers' consent. The interview provided data for the research because the teachers had accompanied their students on the field trip and engaged with them in discussions during the field trip and in the classroom. The teachers had marked tests and portfolios and formatively assessed the external assignments.

The teachers formed impressions of the students' appraisal of the experience outside the classroom, the baking unit, and classroom activities. Potentially this material was a valuable contribution to the research which asked about the benefits of taking secondary school food technology students on an interactive learning experience through a live historical village. The interview was also a significant opportunity for all the teachers to enquire into the effectiveness of the field trip experience and its place in the baking unit, as well as identify any alterations to the teaching plan that needed to be put into place for the following year.

Summary

The data gathering processes implemented in this study were closely allied to the teaching programme. A learning experience outside the classroom was planned to compliment a unit of work for a year 11 food technology class. The brief that the students were given asked them to design a baked snack food product for an identified adolescent market. The field trip was to a historical village on a live day where butter making and baking using older cooking technologies were the main exhibits. Students used the experience to help them with their technological practice preparing for two internal achievement standards and one external achievement standard. The assessment criteria for the external standard prompted the visit to the village. These criteria included students needing to explain the two way relationship between a technological development and changes in society. For the students in the three year 11 food technology classes the technological development concerned a food technological outcome.

The classroom activities that contributed to the data included a pre-test; a visit to a historical village; a post-test; an examination of portfolios including an assignment. A separate focus group interview with eight students was an important research strategy used. Feedback from discussions with students and teachers contributed additional data. These research processes are clearly described above. Following this chapter are the findings that emerged from the analysis of the multiple data gathering techniques described here.

Chapter 4 Findings

Four data gathering techniques, detailed in the previous section, derive the results and analyses described in this chapter. The key question this research addressed was does taking students to a live historical village help them understand the development and social impacts of food technologies. Three themes centred round food technologies emerged from the findings: students learned about the nature of food products; students learned about the development of technologies used in the production of food products; and students learned that food technologies have social impacts. A further impression gained from this research was that students found learning about historical happenings a useful and relevant adjunct for their own technological practice. Feedback from the students regarding the benefits of learning through a guided experience outside the classroom is both threaded through this data analysis and separately addressed towards the end of the chapter.

4.1 The nature of food products

An important part of the visit to The Historical Village was for the students to experience the production of food products in the manner in which they would have been prepared during the era of the village – colonial New Zealand 1840 to 1880. The food products that the students participated in preparing were butter, ginger biscuits, bread and lemonade. Butter and butter making are specifically enquired into in this research and the findings are reported here.

Pre-test & post-test findings

The data that forms the bulk of the findings relating to the students' knowledge about butter and butter making arose out of the tests that were administered before and after the field trip.

Results from the pre-test confirmed that prior to the field trip to The Historical Village a large number of the students were not confident describing facts about the origins of butter. Students were able to describe what butter looked like and what it was used for. The pre-test questions asked students what butter was, where butter came from, how butter was made, and for what was butter used.

What is butter?

Most students (92%) described what they thought butter was. Responses to this question included butter described as a "solid food product made from milk" (Ned); turned, churned, or thickened; and from John "frozen combined with bacteria". Other responses described butter as a yellow dairy product, yellow fat, grease, spread, over whipped cream, and as adding flavour but "not nice by itself" (Tyrone). Butter was also thought to be a type of food product found in most food products and an ingredient used in cooking and baking. Most of the student responses to this question in the pre-test consisted of one idea for instance simply describing butter as the fat of milk.

In the post-test students demonstrated that that they could describe more than one idea answering the question inviting them to describe butter; and more students (38%) wrote full sentences in the post-test where they had written short phrases in the pre-test. Andrew described butter as turned milk in the pre-test and in the post-test described butter as "... a milky, yellow-white solid [with a] long life span [that] has been made for thousands of years". Other students included facts about butter in the post-test not mentioned by any student in the pre-test. For instance butter was described as a useful product; "... a very useful ingredient in our society today and a long time ago also" (Sarah); "... a useful product that has been around for years and was used by the early settlers at the ... Historical Village" (Lydia). Robert suggested that butter was a protein food; Michael noted that butter was an export product; and Yolanda mentioned that butter was preserved using salt.

Compared with the students' pre-test responses, students' post-test responses to the question what is butter, showed more confidence. It was as if the students thought about butter for the first time.

Where does butter come from?

Answering this question on the pre-test four percent of the students mentioned that butter came from cream. Eighty five percent of the students described butter as coming from a cow, cow's milk, or milk. Michael drew a flow chart tracing butter backwards starting with milk → cow → grass → sunlight. The remaining

students described butter as coming from the supermarket, cheese, cow fat, or pigs. Rebecca's response to this question was "no idea".

In the post-test 60 percent of the students including Rebecca were able to describe butter as coming from cream. The remaining students except Callum said butter came from milk or from a cow. Callum said butter came from a dairy farm. A number of students elaborated their answers to include the process of separating cream from milk, and then churning cream to make butter. A few students included further details such as "... edible fat from cows ... cream ..." (Sarah), "... cream the [less] dense substance released when a cow ... is milked" (Tyrone).

How is butter made?

Writing about the butter making process in the pre-test students indicated that some form of agitating milk or cream was involved. Thirty five percent of responses included the word churn or churning. Other agitation words used were turning, shaking, whipping, beating and compressing. Two students described the butter making process as happening in factories and included shaping and packaging as part of the process. Other attempts at describing the butter making process were suggestions that butter was made by thickening, curdling, heating, refrigerating or freezing (four students) milk. Twenty three percent of the students indicated that other ingredients were involved in making butter such as additives, chemicals or salt. Even when unsure about butter and butter making some students made the effort to answer the question. Zoe wrote "Milk goes through a process and the leftover bits get turned into cream, then yoghurt, then butter then somehow cheese."

On the post-test all students described the butter making process or part of the process correctly. Sixty eight percent of the students indicated that cream or the fat of milk was the ingredient. Ten percent of the students called the ingredient milk and the remainder of the students described the process without mentioning the ingredient involved. Sixty one percent of the students referred to churning as the butter making process, the remainder using words such as shaking, beating, whipping and turning. A number of the students included further details about butter making for instance separating butter from butter milk, washing, and

salting. There was no mention of other ingredients or additives being involved in post-test responses.

Uses for butter

A range of uses was described by the students in both the pre-test and the post-test. Lewis said butter was "... used everywhere in cooking" and Rose said that butter can be used "... anything you want". Specific uses included butter as an ingredient in cooking and baking; as a spread on bread and toast; as useful for sautéing and frying; as a substitute for oil; and as adding flavour. In the post-test Robert referred to butter's role in French cuisine and Lisa and Rochelle described butter's role in trade and making money.

On the pre-test students had the opportunity to discuss how butter was an important food product for New Zealand's early settlers. Students noted that "... because of the New Zealand farming industry ..." (David) there were many cows around "... which meant meat, cheese, milk, cream ..." (Zoe). Butter was easy to make; could be made at home; utilised available resources; "people owned own cows" (Diane); was in high demand as a "base for cooking" (Robert) and as a spread on bread. A few students noted that butter was important to make money through local trade and as an export product.

Students' responses to the question on the post-test asking them to describe the importance of butter to the early settlers predominantly focused on butter's role as "New Zealand's number one food ingredient" (Shane) for trade and a "great thing to export because it can be salted" (Michael). Kyle described butter as a 'wonder' ingredient in baking and cooking. Yolanda noted that New Zealand "... made the best butter ..." and Sheila noted that butter "... made us internationally known."

Butter vis a vis margarine

Students were asked to explain how today's 'butters' were different from those made during the time of the early settlers. Given that people frequently use the word butter when they really mean margarine there was no attempt to teach the students the differences between butter and margarine prior to the pre-test. The word 'butters' was deliberately put into inverted comas and written in plural on

the pre-test so that the option was there for students to make a distinction themselves.

The responses from some students suggested that they were clear about the differences between butter and margarine. These students limited their discussion, regarding advances in technology with regard to butter, to there being different types of butter, better food safety, safer packaging, "easy to produce in large quantities due to improved technology" (Nat), and including "rules and regulations" (Michael).

Other students were seemingly referring to margarine when they wrote comments such as "today's butters you can get [the] heart foundation tick and reduced fat" (Lewis). The technological developments that many of the students discussed when thinking about today's 'butters' included made from vegetable oil, contained added ingredients and colourings, different taste, smell, colour, sizes, packaging and labelling, and processed with advanced technology.

As part of knowing what is in food it was important to teach students about margarine especially as responses from the pre-test indicated that the distinction between butter and margarine was blurred for most students. Terminology such as use of the word butter when referring to spreading margarine on bread contributes to this confusion. Rochelle described (post test) margarine as processed butter which suggested the confusion remained for a small number of the students.

A final question on the post-test invited students to comment on the introduction of margarine's affect on the production of butter. Norah wrote that "... you couldn't tell the difference at the start." Most of the students said that more people bought margarine because it was cheaper, more convenient, contained less fat, had a similar taste to butter and looked like butter. Barry suggested that "... people wanted to buy new products ..." and Xena suggested that the packaging and variety suited peoples' lifestyles. A number of the students were aware of the impact of the introduction of margarine on the economy. "It made the butter producers have to work hard to keep ahead" (Michael); "farmers lost money" (Eve); "butter prices did rise" (Roger); and "the export of butter was threatened" (Lydia). Some students including Sarah referred to the impact of legislation controlling the sale of margarine in order to protect the butter industry: "... made

an agreement saying margarine had to be uncoloured or not yellow as it seemed too much like butter and people would stop buying it [butter]".

Focus group findings

A focus group interview presented a further opportunity for students to express their views about the impact of experiencing the butter making process, which was part of the field trip to The Historical Village. Students were asked what they knew about butter making now that they did not know before the trip to the village. Responses included that it was hard work, "... not really a heck of a lot to it" (Diane), hand-made, fresh, natural, contained no additives, tasted better, and was healthier. The theme of natural and containing no additives and a relationship to health came through in the discussion several times: "... some healthy things, even without preservatives and all that is actually really nice and [a] lot better for you" (Xena); "... not other stuff in it like additives ... more healthy" Chloe). The simplicity of the butter making process combined with 'fresh and natural' inspired Lydia "I made my own butter after that at home". Later in the interview Lydia commented "I'll definitely keep making butter at home, it is a fun thing to do, and it's not actually that hard". Diane too supposed that people could make their own butter and therefore have it healthier, rather than "[margarine] all additives.... Don't even know what's in it".

Students in the focus group were asked to what extent the trip to the village helped them understand more about the food we eat. Glen asked "what else could we make on our own like that, how we made butter from fresh and how it used to be back then, what else could we do?" Lydia and Diane commented that we do it with bread. They compared the butter making to bread making using a bread maker; that home-made bread was easy to make, healthier and tastes better. The lack of complexity of ingredients and processing of basic food products seemed to come as a surprise to these students. The students associated this simplicity with 'healthier'.

Additional comments from the focus group participants about the impacts on them in the future, of knowing and understanding more about the history and development of a food product, would suggest that the students were able to transfer their experiences about the technological development of butter into a

new context: “Everything that they were making we have just kind of produced further, evolved as such I suppose” (Diane); and “like factories, we change a lot in ... technology which changes things ...” (Zoe). Norah thought about cost: “why if it’s not that much time, why does it cost so much?” and Glen thought about processing: “think of the additives made for margarine, that’s more processed than butter is.”

Prior to this experience of making food products such as butter, ginger biscuits, bread, and lemonade from scratch, the students thought about today’s food products as being discrete. After the field trip the students saw today’s food products as the outcomes of the processing of ingredients over time not wholly new.

Documentary evidence findings

The standalone assignment that was part of the students’ portfolio of their technological practice provided data that helped address the research question that asked how the learning experience to The Historical Village helped students understand the development of food technologies.

Students who researched butter as the technological innovation to discuss in their assignment described the butter making process in full. For this information students were free to supplement their field trip experiences by accessing text books and the internet. Many of this group of students integrated into their assignments specific facts about butter and butter making that they had gleaned from the field trip. As well as the butter making process, students mentioned specific details from the period of the village such as referring to the local dairy farmer, Mr Hargreaves, who traded with the Fencibles; and they specifically referred to the stamping and selling of butter through the local shop.

Examples from the assignments illustrating how the students integrated their field trip experiences into the assignments included: “The most interesting thing I observed was how the people ... at that time used to make butter from cow milk ...” (Shane).

> When the Fencibles first arrived and were making butter they would have to milk the cow by hand and do all of the steps making butter, by hand.

> They would sell it locally because it wouldn't last if they transported further afield. Butter would also last for a shorter amount of time because they did not have refrigerators (Diane).
>
> I learned about butter churns and the different kinds of them e.g. paddle churn and dash butter churns. I also learned that when people got married the husbands would give their wives a stamp carved with a logo on it for when they make butter they use the stamp to imprint the logo on the butter so when they sell or trade the butter people would know who made which butter (Campbell).

Discussions findings

Feedback from in-class discussions that took place after the students returned from their field trip to The Historical Village suggested that the students learned the butter making process while they were at the village. After the trip Carl commented that butter "comes from cream not milk". Other students made similar comments. Several students said they learned the whole process of churning cream, adding salt, washing, and shaping the butter; that the process takes a while but it is not complicated; and "that it is easier than I thought it would be" (Ken).

Students attributed the village experience as the source of their learning about the production of butter. Students said "actually seeing live examples of food production rather than just hearing about it" (Diane) was a good way to learn. Other comments included "you can watch them do it" (Teresa); "... see it with [my] own eyes ..." (Rochelle); "... I can see the butter made in front of me ..." (Chloe); "... you get a visual so it stays in your head" (Sarah); "... also experience what people went through to make such a simple product and compare it to the improved technology of today." (Xena); "You find the history while learning about how to make the product" (Sharon); "... actually got to experience it and gives us a better understanding of it" (Patsy); "I am able to produce it myself" (Tyrone); and "... it involves you more and makes learning fun." (Roger). Butter making at The Historical Village being a fun way to learn was a response shared by several students.

Teacher interview findings

During the trip to the village students asked a number of questions of their teachers and the village volunteer guides. Breanna (food technology teacher) noted that the students were fascinated by the old foods and equipment and questioned and talked about what they saw. Cherie (food technology teacher) felt that the freedom to walk around the village at their own pace, "constructing their own knowledge" was what motivated the students to ask so many questions. The three teachers accompanying the students on the field trip witnessed queries about butter: How long does butter take to make? Why does butter turn yellow? Won't butter melt when washed? Is the milk from a cow or a bottle? What is the difference between butter and margarine? During a discussion with the teachers after the trip Cherie commented "... they had no clue where the butter came from". Describing the advantages of the field trip as a good method for students to learn where butter came from Breanna said:

> Kids learn by doing, kids learn by seeing, you can talk 'til you are blue in the face but there will still be some kids who don't realise you have to milk a cow first. You actually see this is a bottle of cream. Cream comes from a cow. This is how you make cream into butter. It showed quite clearly the progression and they suddenly go "aah" (Breanna).

Summary

At the beginning of the baking unit and before the field trip to the village most students were able to associate the source of butter as coming from cows or milk. A minority of students, just four percent, described butter as being made from cream. After the field trip to The Historical Village the number of students stating clearly that butter was made from cream multiplied 15 fold to 60 percent. The students attributed their new knowledge and understanding to the opportunity to participate in butter making 'the old way' while on the field trip to The Historical Village.

4.2 Development of food production technologies

Hand in hand with the evolution of food products such as butter goes the development of the technologies used to prepare food. The village experience allowed students to see and participate in using a range of older food technologies

including butter making tools and cooking equipment. The nature of this historical village, and the era in which it was set, meant that the students were exposed to a broad range of baking technologies, and they too were enquired into and the results of this enquiry are discussed here.

The historical village that was the site for the field trip displayed a long period of cooking history in relation to the development of cooking technologies. This was because when the Fencibles arrived in New Zealand around 1840 the accommodation that was promised to be available for them was not ready. The early settlers first lived in tents and cooked their food over open fires. As housing became available the settlers gradually moved into small houses with a simple hearth, and some of them later built and lived in larger homes with open fireplaces or wood and coal burning cast iron stoves.

Pre-test & post-test findings

The first task the students were asked to do on the pre-test was to place illustrated cooking technologies in chronological order from the earliest to the most modern on a given timeline. The same question was on the post-test. I was interested in recording the results of some of the cooking technologies illustrated namely the fire, hearth, hangi, wood/coal burning stove, gas stove, electric stove, and microwave oven.

Timeline of baking technologies

On the timelines of both tests there was a very high level of identification of the fire and the hearth as the first two cooking technologies. Similarly in both tests, students were confident placing the wood/coal burning stove in the middle of the nineteenth century and just earlier than the gas and electric stoves. Not all students were sure about the timing of the first gas or first electric stove. Of the students who completed this timeline on both tests 11 percent were able to place the hangi accurately on the pre-test and 28 percent on the post-test. The number of students placing the gas stove accurately increased from 35 percent to 63 percent; the electric stove from 37 percent to 64 percent; and the microwave oven from 80 percent to 91 percent.

The period of The Historical Village excluded the developments of gas, electric and microwave cooking technologies. There was a Maori cooking exhibit within the village environs but it was static and somewhat removed from the main thoroughfare.

Cooking explained

Students were asked on the pre-test what they understood by the term to cook food and why some foods require cooking. These questions were unchanged on the post-test. Heating food and killing microorganisms were the two most common explanations for the need to cook food. In the pre-test 48 percent of the students indicated that cooking food involved heating food. This percentage increased to 58 percent in the post-test. In the pre-test 26 percent of the students indicated killing microorganisms as a reason for cooking food. This figure increased slightly to 29 percent in the post-test.

Additional explanations for cooking food were indicated on the pre-test by 20 percent of the students. These explanations included giving food taste and the fact that you cannot eat some foods raw. Shane mentioned that foods require cooking "to have ... easy digestion". "... some foods when mixed together form nicer things". (Tyrone). Rose indicated the need to change the nature of the food in some way "... runny like egg and needs to be hardened"; as did Yolanda who wrote "... so that the texture changes and the appearance".

Post-test results indicated that after the field trip 60 percent of the students were able to expand their explanations for cooking food to include more reasons than heating food and killing microorganisms. Further explanations included the need to cook food for enjoyment, to improve flavour and aroma, to make it edible, for palatability, and for nutrition. Edith noted that when cooking food "you may want to go from a liquid to a solid e.g. cake, pudding." Vernon noted "some foods ... need to be cooked to let it rise", both associated cooking specifically with baking. This exploration of food technologies by the students was embedded in a unit of work on baking.

Focus group findings

The focus group interviewees were invited to describe the purposes of an oven; changes and progressions in oven technologies that they had observed while visiting The Historical Village; and how ovens are different today. Students described the main purposes of ovens as cooking food using heat, and killing off bacteria. These responses were consistent with pre-test and post-test responses.

Students were clear about the progression of oven technologies they had observed at the village starting with the open fire outside and ending up with the cast iron stove inside the 'big house'. Features of the cast iron stove, that were improvements on the open fire, were pointed out such as "it would heat up water for tea at the same time cook bread or something ..." (Glen); "temperature control [was] having water on the top, so you knew when it was boiling it was quite hot ..." (Diane).

Many technical features of more modern ovens were identified such as smaller size, glass door, switches, temperature controls, and safety features for example the handle is not hot to touch. The major changes in cooking technologies identified were "different materials [to make stoves] available" (Diane). Diane also mentioned that a major change is there is "more knowledge of what can be safer or easier to use". Norah said "the source of the heat has changed from wood to gas stove to electric oven". Glen said a major change was "more even heat distribution ..." though even after probing none of the students mentioned the thermostat. This advance had been specifically covered in class.

The development of the microwave was highlighted as a major change to cooking technologies. The only student prepared to describe how microwave ovens work was Glen who said "comes from a irradiator little motor/engine at the back that sends out microwaves".

The focus group participants discussed other food processing technologies that they observed during the field trip and how they are different today. Students traced cellars and cooling rooms to refrigerators and freezers; pans and griddles to flat top plates on stoves; simple utensils to food processors and cake mixers; and the roles of electricity and food preservation knowledge in all of these.

Students were asked during the focus group to talk about the impacts on their thinking in the future, after knowing and understanding more about the history and development of food production technologies. Robert talked about the limitations of earlier technologies for cooking food. Norah wandered how they (early settlers) managed with so little resources. Chloe and Diane compared the washing machines and driers of today with washing in rivers and hanging out on a clothes line. Diane also commented on today's dependence on electricity for light and entertainment. She thought about a recent power cut and the inconvenience of not being able to use her hair drier. Lydia wondered how food used to be weighed and measured and Xena was concerned about today's technologies polluting the air more.

Documentary evidence findings

About one third of the students across the three classes chose the oven as the technological innovation to write about for their assignment. Some students wrote about stoves in general while others were quite specific about the cooking technology they chose to discuss. There were a few students who chose to discuss a cooking technology that was of cultural or familial significance for them personally. These technologies included the Pacific Island Umu, the Philippine Ulingan, the Indian Tandoor, the Fijian-Indian Chula; as well as the George Foreman Grill, and a pizza oven. Several students selected the microwave oven as a technological innovation to research.

In the same ways as students researched and wrote about butter for their assignment, students who selected the stove (%) as the technological innovation to study, integrated into their assignments specific facts about cooking and cooking technologies that had been gleaned from the field trip.

Most students who completed the written assignment began by situating their research in the context of the visit to The Historical Village. Some carried on this theme and incorporated their field trip experiences, as well as observations and comments about cooking technologies, into their assignments: "we also learned about the oven and how important baking was to society up to 150 years ago, and how the tradition of baking is still continued today" (Lydia); "the village taught us many things about the olden days and how people cooked ..." (Laura); "I also

observed how they used to cook and bake food. They didn't have modern day technology of gas stove, electric stove, or microwave but they used firewood for cooking and baking ..." (Shane); and "when we went there we made bread and butter using those old fashioned appliances" (Teresa).

A few students referred to technical features of the cooking technologies they observed: "heat regulated by lowering [cooking vessel] up and down on a chain" (Vernon); and " a three legged pot with a domed lid surrounded by a gutter to keep hot embers on top of the pot was used by many women to bake bread" (Lydia). Andrew described the function of the chimney in filtering smoke, the wet back facility in the cast iron stove, and the introduction of coal.

Discussions findings

Feedback from discussions after the field trip to the village would suggest that the students felt that the field trip to The Historical Village was a good way for them to learn about the development of cooking technologies over time. The students compared today's cooking technologies with those in use at the time of The Historical Village and were able to discern that "technology has come a long way" (Carl) and that "it was very different compared to today's technology" (Delia). Several students displayed an increased awareness of the role of fire in cooking. Vernon noted that "you can cook food on fire". Robert said that he "learned that fire was the source" of methods of cooking. Anna explained that "embers of fire cooked the actual food in the dish not the actual fire". Several other students shared Anna's insight. Discussion also suggested that students appreciated that basic methods of cooking simple food was hard and time consuming. Many were able to discuss technical challenges cooking then, that most people do not have to face today, such as " you would have to find wood and cut the wood" (Sharon); 'you couldn't just turn the oven on when you wanted to, you have to keep it going running pretty much all day" (Carl); "having to turn the food products in order to get an even cook on each half" (Xena); and "they do not know what heat [temperature] it was cooking at" (Ashley).

Teacher interview findings

Breanna (food technology teacher) described how the trip to The Historical Village helped the students learn about cooking technologies:

> It traced the history ... and it gave them that link from the past to the present so it linked what they thought they knew with what they actually learned and how relevant it is today, so you get the past, present and the relevance all wrapped up in one (Brenna).

Summary

The field trip to The Historical Village stimulated the students thinking about food production technologies. Students came away from the trip with clear ideas about the progression of cooking technologies exhibited at the village. Their own exploration after the trip prompted some of them into extending their research to include later developments such as gas or electric ovens. Students were more comfortable discussing features of the microwave oven or an oven that had cultural significance for them. Students identified a range of features, their benefits or limitations, for the cooking technologies they described. Students' experiences, engaging with the cooking technologies while on the field trip, were an important source of information for them completing their assignments.

4.3 Social impacts of technology

A field trip to a historical village that traces the development of food products and food technologies is likely to portray insights into the lives of the people for whom these technologies were commonplace. This is especially so in a village whose guides dress in period costume and prepare and make food in older ways using older tools. Two of the technological developments exhibited at this village, that were the focus of enquiry in this study, were the developments in butter production and the developments in baking technologies.

During the period represented by the village butter moved from being made at home to being made in a dairy factory; and the cooking technologies displayed ranged from an open fire to a wood and coal burning stove. These advances in food technology provided an opportunity for students to observe and discuss how changes in food technologies can impact on a community. The results described here explore what the students learned about the impacts of the development of food technologies on society.

Pre-test & post-test findings

Questions on the pre-test asked students to identify major changes to cooking technologies that developed throughout history, and to suggest factors that might have prompted these changes. Most students identified electricity and gas as the key changes in cooking technologies. Several students also included the introduction of the microwave oven. Three students indicated that moving from the open fire to heat that was enclosed was a major change and two students indicated that the availability of steel was a major change. Factors prompting these changes included general statements about advances in technology such as technology "... has become way more sophisticated and reliable and safe" (Tyrone); "grew" (Sarah); "became higher" (Yolanda); and "evolved" (Nick and Lisa). Two students mentioned the need for cooking technologies to become safer because of "household accidents" (Patsy).

Students indicated that "the demand for technology [to] change" (Sean) was stimulated by "too much work and not enough time and everyone wants it more efficient" (Rose). Words such as time, energy, effort, and convenient arose in a large number of responses from the students. Laura wrote that new generations required new necessities. "People were smart and tried to make things easier for everyone" (Anna), had "knowledge of how things work" (Sarah) and were "able to invent" (Delia). Tyrone and Carl noted that a rise in population, a variety of new foods available, wanting better tasting food and new cooking styles contributed to changes in cooking technologies.

Similar responses were given to the same questions on the post-test. The discoveries of gas, electricity and microwave technology were identified as the major changes to cooking technologies over time. The cooking technologies became smaller and other complimentary new developments such as the rice cooker and blender, for example, were associated factors in instigating change.

The societal factors prompting change described by students in the post-test included factors mentioned in the pre-test such as an increase in population, and the consumers' demands for fast, convenient, reliable, and safe food preparation equipment and techniques. As Lydia wrote "inconvenience has prompted these changes". "The knowledge of a human" (Barry), knowledge of "science,

engineering and technology" (Nick), as well as trialling and testing were prompts suggested by students. The suggestion that new ideas came about after experimentation was mentioned by several students. Shane wrote that "... food technologists gathered and designed new machines which could make food easier, faster and safer." Delia wrote "... trying things out, in the end they were successful so it became a new change. Technology improved."

Focus group findings

Responses from the focus group interviewees illustrated students' understandings about what was happening in the lives of the Fencibles during the period represented by The Historical Village; and the events influencing the development of the food and cooking technologies.

The students (50%) talked about the kind of societies the Fencible families came to compared to what they had left behind in England and Ireland: "A more basic one, they were sort of used to having more technology than what was there when they got here. They didn't have houses, they weren't complete, so they have gone back in time rather than moving on" (Chloe); "... developed less" (Glen); "... basically started over their lives ..." (Lydia).

The students identified societal factors that influenced the Fencibles' food habits and access to food technologies, preparing and making their own food. Glen commented that the Fencibles brought knowledge with them "... of family recipes, things they knew they could make with what they had" and Lydia added "they had to be really flexible to be able to cook with whatever stuff they had, they couldn't just have everything". Diane's comment showed the early settlers had an awareness of a need "to develop more things, but they were sort of happy with what they had at the time ... but then as technology developed learning more about what else they could have, what else they would like ...".

Students in the focus group explained why they thought specific societal factors initiated changes in the Fencibles' access to cooking technologies. Lydia said "They were being moved into bigger houses so they had space or capabilities to add." and Glen added that they were "getting jobs so they had money so they could have better technologies in their house" and also " ... places opening up where they had the equipment to make ovens and things ...". Zoe commented too

that there were "factories manufacturing at the time" which contributed to new technologies affecting the Fencibles' lifestyles.

Students were aware of the impact of the developing technologies on the lives of the Fencibles. The coal range "... gave them [a] wider range of what they could actually make, what they could do with still just heat, but use it in so many different ways." (Glen). The coal range gave the early settlers "ideas of how to produce something further. They use the heat that was rising from the oven to dry the washing on the top. The heat can do a lot more things that just cook the food" (Diane). Several students commented that the newer technologies were more convenient, easier, and less time consuming. As Xena noted "you can go and put something on [top of the stove], go and check the laundry or something ..." Xena, Chloe and Lydia discussed potential wider affects of the introduction of the coal range. The early settlers needed to find wood, cut down trees, as well as access other new resources such as animals and food ingredients. As Glen said "they [saw] the environment as something that would aid them in everyday life ..."

Documentary evidence findings

The students' standalone written assignments provided valuable material regarding their understandings about the relationship between events in society and the development of food and food technologies. Many students began their assignments with a timeline or overview of the development of butter and/or the cooking technologies encountered during the visit to The Historical Village. Some students continued by identifying and discussing developments beyond 1880, and in some instances projecting developments into the future.

Butter

The history of the production, distribution and consumption of butter provides insights into the social, economic and political relationships in New Zealand from the beginnings of European settlement through to the middle of the 20th century (Steel, 2005). The early developments portrayed at The Historical Village mirror the developments outlined in Steel's research:

Steel (2005) discusses key events influencing the development of butter:

- Dairying as an important element of settler self-sufficiency and the home economy
- Development of techniques for preservation and packaging
- Increasing herd size; bartering excess butter
- Farm production exceeding local consumption
- Britain identified as potential export market
- 1882 – refrigeration; factory production; export
- Breeding technology
- Margarine Acts of 1895 & 1908 regulating margarine production, sales and colouring
- War
- Branding
- Nutrition knowledge (vitamins); butter declared supplementary energy food (1935)
- Subsidy removals on dairy products (1967); price increased;
- 'Bad' attributes of butter identified; margarine entered market

I read the written assignments that the students prepared discussing a technological innovation. Most of the assignments were about butter and a handful (13) was about the stove. Key events in the development of butter highlighted by 91 percent of the students included references to many or all of the events in the list above. In these written assignments students used their understanding of the impacts of these key events to talk about their influences on society. Illustrations from student work describing some of these key societal impacts are described here:

Most students like Teresa noted that "in the olden days butter making took time and energy" and now 150 years later "the jobs are easier and butter churns are motorised". Xena suggested that this was because "we have become more of a lazy society, always wanting to make life easier, with any cost including the risks of more processed food".

Students described how the impacts of new knowledge affected the development of butter. "in those days they did not know about health and safety" (Vernon); "knowledge has grown about preservation of butter like salting, cooling, storing

and how it affects the quality of the butter as it goes off easily" (Rose); "because in the days of the Fencibles they did not have the technology to find out these things but with the food industry developing we are now able to know exactly what is in our products" (Glen).

Butter and its impacts on health was a popular topic discussed by the students in their assignments. Many students were aware of the to and fro in attitudes over the last 150 years, towards butter as a food choice; reflecting the nutrition knowledge of the time. Lisa fully described a current view of butter as "high in fats such as cholesterol making its consumption a health issue". Lydia pointed out that butter "swings between positive and negative value to society" because "butter was known to provide energy and people were becoming more and more aware (referring to 1930's period) of the nutritional benefits of butter how it contained the vitamins A and D".

Several students talked about selective breeding for example:

> They [Fencibles] started to get fussy in their cattle and the ways their cows produced milk and the rest [other dairy products] for their families bringing in something we call selective breeding of the cows where the Fencibles would choose which cows were producing good products and the cows who weren't. These changes played a huge part in what our society is like today (Zoe).

Tyrone debated the impacts of the technological advances he discussed:

> The importing of cows provided Fencible families with a source of income. It was also a source of milk, butter and cream. As a result of this change the New Zealand dairy industry emerged.... However a negative consequence was all the new diseases introduced to native Maori and other species. The farming of New Zealand land has provided space for farms and civilisation as well as contributing wood for homes and buildings. However it has reduced amount of trees in the world and destroyed many different sections of native life and environment nationwide.

The relationship between the development of the dairy industry and the growth of the New Zealand economy was clearly articulated by students. Robert's summary

captures butter's economic history thus: "During the 1800's to 1880's butter was a marketable valued product in New Zealand. It was mostly bartered than sold for money. In the 1880's butter was a surplus for families as they could trade butter for other food or farming tools. The storekeeper would then sell the traded butter for profit". Lisa described women's role contributing to the economy: "At the time it [dairying] also provided work for women and girls and income for families ... now butter and other products of the dairy industry are major export products and are a major source of income for New Zealand's economy". Diane described how women's roles changed throughout the history of the dairy industry:

> In the 1800's milking cows was generally a job for women and children. Now, in the 21st century there are far more men than women in the industry. Women are now starting to make a comeback in the dairy farming industry which just goes to show that through the time the popular gender for dairy farming can change dramatically.

Students discussed the advent of refrigeration technology and linked this event to social changes and the economy: "the first place to export to was the 'Empire' which is where the Fencible families came from" (Glen); "butter was shipped to and from the UK and brought back animals, equipment, machinery, food and fashion" (Nat); and refrigerated cargo ships (1882) "developed and turned into refrigerated vans ... opened up jobs and supplied New Zealand families with an income" (Travis)".

The intervention of the Government protecting the dairy industry and the impacts this had on the development of margarine in New Zealand was a common thread in the students' assignments.

> In 1869 margarine was invented which is very similar to butter. Margarine is a processed vegetable oil which has been hardened. This was a major threat to the butter industries. The margarine act 1895 re-enacted in 1908 regulated the sales of margarine in New Zealand. This act prohibited colouring margarine so it didn't imitate butter. This left the margarine to look an unpleasant grey colour. Margarine was to be labelled clearly and manufacturers required an annual licence. (Norah)

The students' written material illustrates a number of other key events in the development of butter and dairying and describes their affects on society. Assignments include discussions on the climate, the environment and the world wars:

> New Zealand climate is very good for dairy farming the weather conditions are not too harsh for cattle and we do not get major droughts like other dairy farming countries such as Australia this make butter making easier and cheaper for New Zealand because we do not have to spend so much money on feed for cattle because the grass in New Zealand is in bigger supplies than in countries such as Australia (Diane).
>
> People now know much more about greenhouse gases. One such gas is carbon dioxide gas, it is emitted by cows, and this contributes to global warming as the mass emission of these gases in to the earth's atmosphere is said to be the leading cause of global warming. (Lisa)

"During WW1 & 2 butter was sent off to the UK to 'provide for King and Country' as well as troops, so it was rationed out in New Zealand" (Tyrone). "After WW2 in the 1950's butter was rationed for civilians in New Zealand at the expense of making sure Britain got plenty as well. The war left very little in shops so rationing was important" (Norah); and "troops overseas receiving our tinned butter were reminded of home" (Campbell).

Cooking technologies

Students tended to create timelines of cooking technologies experienced by the Fencible families during the period represented by The Historical Village which is 1840 to 1880:

- Open fire outside
- Simple stone hearth with chimney inside accommodating a camp oven
- Brick fireplace inside with attachments such as a pulley, griddle etc
- Communal brick and mortar bread oven outside
- Cast iron wood burning stove

Norah made a timeline of the cooking technologies at The Historical Village. She began her timeline with the signing of the Treaty of Waitangi in 1840. This year is

the beginning of the period represented by the village and about the time when the decision was made to bring Fencible soldiers into New Zealand. Each point on the timeline is linked to a cooking technology, accompanied with photographs, and the progress of the Fencible families living arrangements at that time. Norah's account finishes with a description of the communal bread oven and well. Xena and Lydia also created timelines of the village cooking technologies as part of their introductions to the assignment.

Students continued a discussion of oven technologies according to their particular interests. A popular oven technology discussed was the microwave oven. Students see the role of a microwave oven for society as an important time saving appliance. "By the changes and needs of society the microwave became a practical necessity which reduced the amount of cooking time and the amount of energy and power used" (Norah).

> Some added features that the modern day microwaves have now are simple things like timers, different heat settings, and a handy timer setting that will automatically set the time you want to cook food. These types of small features have made the microwave so much more popular in everyday cooking. It means that a lot of time is saved in cooking which appeals more to the modern day user. In the 21st century we citizens are more impatient and therefore dislike the idea of slow cooking (David).

An emphasis on convenience, saving time, and energy came through in discussions about ovens in general.

> As the ovens have developed to be more advanced the faster it has become to cook a meal. For example it would take a while to cook a meal with a wood burning oven because you would have to keep fuelling the fire but with an electric oven or a microwave it is much faster to cook things (Bella).

> Before heat was contained in the oven it was off [at ground level] the ground. The heat was controlled as the fire was enclosed... here are some of the innovations on today's stoves: glass door (for visible cooking), a heat resistant handle for opening the oven door, a thermostat (to regulate heat and select the type of cooking e.g. bake/grill), and racks (a lot of food

> can be baked at the same time). There are factors in society that prompted these changes. One factor is the need to cook faster.... People also wanted to reduce the workload that they have to do (Chloe).

> This technological advance [modern oven] I think is important, that has originated from the open fire to the technology we have today. With the changes in society the plain fire would not have been accepted in a growing city because of the growth in the community the houses would become close together for an open fire outside, so as building and other technology evolved the cooking technology used by the Fencibles would have to become more modern to keep up with the times. When Auckland started to growth a population the outdoor fire was not considered practical so the Fencibles developed a way to keep the fire inside although with the fire inside smoke filled the room, this problem was solved by having a chimney. This chain of having to improve the living and cooking dependent on the technology in the world today is still the same today. A ten year old oven will not be as good as a brand new one the technology used to create it has changed and become more upmarket (Andrew).

Students mentioned that to meet the needs of society today cooking technologies were required to be affordable and safe. “The benefits of the gas stove it is cheaper to run than the electric stove/oven, the gas stove heats or cools down faster to the adjusted temperature than an electric stove/oven. The benefits of an electric stove/oven it comes with an oven to do the baking and it is less dangerous to use than a gas stove” (Norah). Bella linked the newer cooking technologies to the changing attitudes towards cooking methods and nutrition.

> The big issue nowadays is healthy eating. Lots of people have decided that frying is unhealthy (which it is) and have decided that grilling is better. This means the sale of cooking technologies like grills, barbecues, woks, steamers and crock pots are rapidly becoming more popular as people think more of healthy eating and easier cooking (Bella).

Zoe did not see the impacts of developing cooking technologies in isolation. She also reflects on the fact that knowledge is required in order to access technology.

> As technologies were changing ... inventors started to focus on more efficient ways to keep people entertained e.g. TV places to go today we can go to amusement parks, malls, ice skating etc. And easy things like toys. ... The way we live today is a lot more technical and advanced than the people who lived 150 years ago would have no clue what to do. But then sometimes we forget that if we went back and tried to make food the old fashioned way we may have troubles too (Zoe).

Xena perceives technological development as part of a continuum of development. "We have access to a lot more materials which lead us to these big discoveries. The advances which technology give to the public in general is a push forward – what else can we achieve in the future" (Xena).

Discussions findings

Six months after the class visit to The Historical Village, at the same time as the students submitted their portfolios for final assessments, the students were invited to contribute to a discussion about the effects of the field trip to The Historical Village on technological change, and their understandings about the impacts of technology on society. The students had just polished their technological innovation assignments in readiness for external assessment. The portfolios and assignments were handed in together. I was interested to hear from the students how the field trip helped them with their assignments.

The students said that an in depth view into the past helped them understand technological change. Examples of reasons describing how the trip helped students' understandings are described by the students themselves:

For Norah going on the field trip meant that:

> You could relate to what the cooking technology was like back in the 1840's because we got to cook/visualise/interact with the old technologies. It made it interesting because we got to see what/how the ovens worked. Through going to the trip we realised that the old technologies are a lot harder and not as convenient as today's ovens;

"It helped me understand change in technology as I got to see how manual labour use was previously"(Xena); "This helped the class and myself understand that the

changes in society also change the different technologies we used back then and today" (Zoe); "it showed us just how important technology is to us" (Glen); "Because I was able to see first-hand how the early settlers would have lived when they first came to New Zealand" (Lydia); and "Showing the development we have been through and the changes in society that affected the technology" (Andrew).

"As society discover more about other resource such as electricity, there is an improvement in the technology of oven as well. Electric oven is used. As electric oven is introduced to us, society stop using fire to bake their product" (Leslie).

"By storytelling by the people in the village and by viewing the equipments in the village; By learning from people how things have change overtime" (Shane).

> It helped me understand the lives and technological food processes of Fencible settlers. Because it showed us what the technology was like back in those days and how it has advanced since then. Mainly changes in society between then and now were expressed by the people dressed up. It has shown me that what we take for granted today was a lot harder in that day (Tyrone).

"Showed that cooking took longer and required more attention back then. We wouldn't have such busy and active lives if it still took this much time to bake bread in a modern day. Quicker more efficient ways of cooking allows people to move around much faster and eat food on the go" (Nat).

"By seeing how things were cooked, made me not just take for granted what technologies we have today" (Carl); and "Looking through the years and thinking about how the ages were really harsh" (Sharon).

Rochelle clearly enjoyed and remembered vividly her visit to the village: "... information about ovens and butter and a better understanding of the drastic changes. It was amazing. It was good so we know what affect it has on our daily lives".

Students looking towards the future

Students demonstrated an awareness of and optimism for ongoing technological developments – developments that have the potential to meet today's needs and address future problems. Comments such as:

> I believe that science and new discoveries will solve things in the future. Additional ingredients will be added to butter to suit people who have allergies and health issues. Genetics will resolve unhealthy food. There will be more genetically engineered foods and animals, e.g. genetically modified cattle. New technologies will be invented for farming and factories. Space will be used more efficiently and there will be more ways to sustain the natural environment (Robert).

"maybe with technology advancing as quickly as it does maybe it [butter to be healthy] will become a reality (Rena); and "in the future scientists will make butter a functional food which will be modified to enhance the bioactivity and have health benefits" (Norah).

> Cows are the main source of milk to produce butter making this is a huge issue within butter's production.... But one day a technological advance could lead to the production of cholesterol free butter and the genetic modification of cows to make them produce very little or even no carbon dioxide emissions (Lisa).

> Current economic crisis and the climate change, some rather interesting theories could impact the further development of the dairy industry – now that the prices of food have gone up, baking has become an alternative to buying food products like biscuits and cakes. This change has increased the sales of butter and milk as families find it more economical on their wallets to make baked goods for their families rather than buy them. This has brought back many tales of the Fencibles and recipes that have been tweaked to fit today's society (Mason).

Summary

When students were asked to focus an investigation into a specific technological advance such as butter or the oven they showed in their writings, and through discussion that they could research and document the history and social impacts of a chosen innovation. Students were more likely to select an innovation to research that was significant for them such as one from their own culture, or familiar to them such as one that they use, for example the microwave oven. Students were confident and willing to discuss a food technology such as butter after learning about its origins and how it is produced.

The visit to The Historical Village allowed the students to step aside from a contemporary context selecting foods and using food technologies, and engage with these technologies from a different era. The students compared the older technologies with those of today. Through thinking about using the earlier technologies the students became aware of their technical features and their perceived limitations. Thinking about the benefits of today's technologies in comparison introduced the concepts of technological development and change to the students. Some students were able to take a critical look at the past and present events and begin to imagine optimistically, developments in the future.

From discussions and in their writings it was evident that the students' understandings of technological development and change were linked to factors in society that precipitated change. Students who wrote about butter understood the importance of the dairy industry to the New Zealand economy, both in the past and in more recent times. Students also understood some of the wider ramifications of a developing dairy industry, for instance effects on the environment, nutrition, and employment to mention a few. Students who wrote about an oven were able to show how an innovation was shaped by the needs and wants of the consumers, such as the need for technologies to be faster and easier to use, prompting further inventions, adaptations, and improvements. Students were also able to describe how innovations were shaped by new knowledge, for instance new materials such as metal; and new technologies such as refrigeration, gas, and electricity.

Some students grasped the two-way interaction between the development of an innovation and how it reacted with society. A popular example from the research findings was the job opportunities and greater spending power stimulated by the growth in the dairy industries which was a consequence of the success of the export market.

4.4 History

A visit to a historical village by its very nature is a journey into history. The students on this field trip demonstrated that they gained ad hoc historical understandings through a visit with a prime focus on food technologies; as well as specific views of learning history that related to technological practice – their own and that of their forebears.

Documentary evidence findings

Almost without exception the assignments the students prepared included evidence of individual research into history. Students prefaced their assignments with an introduction or background setting the scene for the technological innovation they had chosen for their study. Ninety two per cent of the students situated their research around colonial life in New Zealand between the 1840's and the 1880's. As well as discussing early foods and cooking technologies from that period, students talked about other aspects of Fencible life including playing, soldiering, and difficulties associated with emigration for example housing.

Students who wrote about butter as their technological innovation went into considerable detail describing butter and butter making, its history and development over 150 years in New Zealand.

Similarly students who selected the stove as their technological innovation to discuss presented material relating to the history of cooking technologies. Unlike the butter accounts the stove accounts were very diverse. Half of this group of students chose to write about the history of a specific cooking technology such as the microwave. Forty four percent of these students also researched the history of a cooking technology that was of special interest to them such as the Tandoor, Umu, or pizza oven.

A range of comments extracted from the students' portfolios explains how the students connected the need to know history with their technological practice designing and making a baked snack food product. "History has created traditions among families ... I can get ideas for my own product from something that past people have enjoyed and I can carry on the tradition" (Yolanda). "I do need to know the basic history of food ... [to] carry on the tradition of baking" (Lydia) and understand "how baking fits into our culture" (Sarah).

Practical reasons for learning history included: "To create a new recipe you need knowledge of previous recipes to be able to build on them and make them better and more suited to the purpose you need them for" (Diane); "without past recipes and experience, techniques and recipes wouldn't have been perfected and made better" (Laura); and "to learn from the bakers before us ... their knowledge and tips" (Bella).

Discussions findings

Feedback regarding the visit to The Historical Village and how the visit impacted on what the students learned about history arose from the targeted discussions.

Robert said it was a worthwhile experience going to the village because "I came here [New Zealand] only four years ago; coming to the village means I learned a bit of history." Carl said "I learned more about New Zealand's history; a first person look at life back in the age of early New Zealand settlers." Chloe said "... knowing where the technology we use now started is really interesting." And Rochelle said "We need to know the history of the tech process." More specifically "I will know what baking is, why baking was so popular in its beginnings, and what were its intended purposes" (Lisa).

When the students were invited to reflect on the field trip as a good way to learn and help them with their written assignments, many of their responses suggested that they had engaged with historical thinking. "The trip helped me understand visually about New Zealand historically" (Xena); "... showed me reality back in the days and how people lived" (Anna). Charlotte and Carl both mentioned that the trip showed them how their ancestors lived and cooked. Shane said that the trip to the village was "a good way to learn about the development of cooking over time so that you know the history of food production". Other students

specifically indicated that they learned about the history of food and food production from the trip: “It showed you how to do food technology and cooking over time” (Roger); “the history of cooking from 150 years ago ‘til now” (Sheila); “it showed me about the way they used to cook ... it helped me understand the lives and technological processes of Fencible soldiers” (Tyrone).

Not all historical references were about food and food production. Students demonstrated that they gained historical understandings such as “... seeing what daily chores and jobs were done then” (Sean); “We learnt how children used to play outside coz there was no technology or computers available” (Lydia); “You could see how different technology was and that kids used to play outside and not on the computer” (Eve) and “the village taught us many things about the olden days and how people cooked, cleaned and even behaved back then” (Laura).

Diane described a benefit of the trip as giving her “... a better understanding of the links between past and present technologies”. Comparing past and present technologies was a recurrent idea expressed by the students providing feedback on the field trip: The trip “... compared the different ways of cooking in different technologies” (Carl); “... shows a technological change” (Sean); “showed us what the technology was like back in those days and how it has advanced” (Tyrone); and “... helped us because we could compare our own kitchens and food products with those of the Fencibles”.

Explanations for technological change were expressed by Zoe who said “As the generations get older we change also, taking technology with us. As we change technology changes with us” and Laura who said “People adjust to new technologies learning how to use it in their everyday lives”.

Summary

Students found learning history interesting and relevant to their technological practice. They suggested that it was important to know the history of foods and baking in order for them to understand and use the baking technologies of today. The students made comparisons between the technologies of today with the technologies that have gone before and they said this enabled them to understand technological change.

4.5 Learning experiences outside the classroom (LEOTC) findings

One month after the visit to The Historical Village the student participants were invited to sum up the benefits of this field trip, when they were asked to compare learning about food technologies from the teacher in class, with learning about food technologies through going on a field trip. All the students had something positive to say about the experience.

Key benefits described by some students were that the experience was fun, visual and interactive. Glen said the field trip was a fun way to learn because he could see the resources in action. Comments such as "I actually get to see the stuff for myself" (Tyrone); "it is more entertaining looking at real life" (John); being able to walk around the village and interact with the activities" (Chloe); "you get to see and experience what they [Fencible families] had done instead of just hearing about it" (Eve); "you get to see things unlike when you get shown pictures"; (Eliot); "It was more practical, since we were able to see and do it ourselves and more fun to learn about how they [Fencible families] lived and worked" (Lydia); and "because it is something visual and also we did a practical which is more interesting than listening to someone speak" were typical of comments made by students about the contributions of the field trip to their learning about food technologies.

Tabitha's comment established a context for more specific comments discussing what students found interesting and enjoyable: "to see how people lived 150 years ago was really amazing. It actually showed us what they used to eat and how they cooked their food". Robert said "... learning the process of making butter and where it was from. It's a good way to learn about food production"; "you can see what they [technologies] looked like and you can see the parts and how they changed through the years" (Rochelle); and "you can actually see how it was done and get an idea of how hard it was" (Yolanda). This feedback suggested that students could connect to the historical period.

The students benefited from the extent to which Fencible life 150 years ago was represented as authentically as practical, particularly the fact that the village guides managing and demonstrating village life were dressed in period costume. "We get to see how it is done and not only with our minds" (Kyle); "because the people played in character which made it more realistic" (Sean).

Carl refers to learning styles with his comment “Because its physical and some students learn better if its hands on stuff” and Ashley has a sense of her role in this research when she commented “because it shows you rather than tells you, it’s a good experiment”.

Summary

References to something seen or experienced, while participating in a field trip to a historical village on a live day, are plentiful in the data described in these research findings. The students enjoyed the experience because it was authentic, relevant, and involved them in the practical activities making food products using older cooking technologies.

4.6 Research findings a summary

In this chapter I have presented the results of an enquiry that investigated the benefits of taking year 11 food technology students to a historical village on a live day. The research questions asked:

- What are the benefits of taking secondary school food technology students on an interactive learning experience through a live historical village?
- How does this experience help students understand the development of food technologies?
- How does this experience help students appreciate the complex interface between food technologies and society?

The data collection techniques used to address the questions were pre-testing and post-testing; a focus group; students’ written material; and feedback from the students and their teachers after the field trip to The Historical Village. The two technologies explored as vehicles for determining the benefits to the students of the field trip were the food product butter and the cooking technology the oven. From their experiences at the village the students were also invited to discuss the interrelationship between developing technologies and changes in society.

The findings from the research suggested that students do not necessarily know what is in their food or how food products are produced; students can investigate cooking technologies, current and from the past, and see today’s technologies situated within a timeline of technological development; students can identify a

range of societal factors that have influenced the evolution of cooking technologies; and students can see how new technologies impact on the communities accessing them.

Further findings that arose from this study were that students do develop historical understandings and are able to incorporate these into their own research. An important outcome from the findings of this research was that the food technology students enjoyed, and found helpful for their learning about food, an excursion outside the classroom to a historical village on a live day.

Chapter 5 Discussion and Conclusions

The findings from this study provide rich data that help to answer the research questions which were:

- What are the benefits of taking secondary school food technology students on an interactive learning experience through a live historical village?
- How does this experience help students understand the development of food technologies?
- How does this experience help students appreciate the complex interface between food technologies and society?

This chapter discusses the findings in light of these questions and the literature that was reviewed in chapter two.

5.1 Food and food products

This discussion regarding the research findings and food and food products addresses the second research question which asked how a learning experience outside the classroom to a historical village on a live day helped students understand the development of food technologies.

The research findings from the pre-test revealed that prior to participating in the field trip the students knew little about what made up an everyday basic food product such as butter. At the beginning of the study the students were asked to describe what they knew about butter; what it is, where it comes from, how it is made, and what it is used for. Two students (4%) indicated that butter came from cream. Eight five percent of the students described butter as coming from milk or from a cow. The majority of students not knowing what is in their food, in this instance butter, is consistent with the views of a number of writers who claim people rarely consider where their food comes from and how it was produced (Mallet, 2005; Oliver, 2008; Planck, 2006; Pollan, 2008 & 2006; and Schlosser, 2002). The lack of knowledge about food could be attributed to less time spent at home selecting and preparing food (Planck, 2006 & Pollan, 2008); and changed approaches to cooking and eating associated with a transfer of responsibility for supplying food, from the family to the food industry (Kurlansky, 2002).

International research into food technology curricula suggests that some responsibility for de-skilling of young people might be a consequence of a shift in emphasis in curricula from a domestic context to an industrial and commercial context (Jolley & O'Neill, 2001; Rutland, 2008; Stitt, 1996).

During the field trip to The Historical Village the students made butter by hand from cream. They used traditional butter-making equipment and the process was demonstrated and explained fully by the village guides. After the field trip data from the post-test showed that the students had a lot more to say about butter. Sixty per cent of them were confident describing butter as coming from cream. Most students remembered and were able to discuss how butter was made.

The students spoken to in the focus group described how they now realised that butter making was an easy process and that maybe other foods too were straightforward to prepare. The focus group participants were interested in discussing concepts of healthier food options and associated natural, no additives, as being preferred foods to consume. One of these students expressed concerns about consuming margarine as she did not know what was in it. Discussion with the focus group participants suggests that as students acquired understanding about butter that stimulated their thinking about other foods. All the students in the focus group showed enthusiasm when talking about the history and processing of the foods they were given the opportunity to learn about during the field trip to The Historical Village. Catherall (2009) observes that students when given the opportunity enjoy the whole process of cooking just as much as eating the finished product. The students' willingness to discuss food and health issues is encouraging because it relates to the views of several writers who say that learning about food is important because it adds to the satisfaction of eating and can contribute positively to health (Planck, 2006; Pollan, 2006; & Schlosser, 2002).

The importance of students having a foundation of solid technical content knowledge about food and food products is supported in the literature by Turner and Seemann (2006) who would like to see students develop understandings that provides for future careers in the food industry; and also Street (2006) who would like to see students develop understandings that enable them to make critical decisions about healthier food choices.

5.2 Food production technologies

The research findings indicated that prior to the field trip students were aware that some sort of fireplace was the first cooking technology. Students were aware that gas and electricity were more recent heat sources for cooking but students generally did not know the timeline for their development. Most students were confident describing the microwave oven as a newer cooking technological advance. Students were exposed to several cooking technologies while on the field trip to The Historical Village but the era represented at the village did not include the advent of gas, electricity, or microwaves. Post-test findings marginally expanded on ideas stated in the pre-test.

When it came to writing about cooking technologies in their assignments, most students included descriptions of the progression of technologies they had witnessed and experienced while at the village; and only a few included the later advances of gas and electricity. Hennessy (1993) suggests that students' learning relates to the meaningful or familiar social context in which it is embedded. The students may have chosen to write about the food technologies from the village because their teachers encouraged them to do so; and the students had ready access to extra resources. Some students may not have had experience with the cooking technologies at home and felt comfortable discussing technologies that they had used recently.

Some students included additional material in their written assignments; a number extending their discussion to include the microwave oven which is a newer and contrasting cooking process to technologies using direct heat. Data from the pre-test also showed that students readily identified the microwave oven as a significant technological advance. Choosing to single out the microwave oven appears to be because the students are somewhat familiar with its use and functions compared to their knowledge or use of traditional gas or electric stoves.

Just under half the students indicated on the pre-test that cooking involved heat. This number increased to 60 percent on the post-test. Derven (1999) is concerned that cooking food without a direct heat source (microwave oven) severs the connection with fire and the 'heart of the home' is disappearing. During a discussion after the field trip several students made the connection between cooking food and fire and the students said that they became aware of this

connection as a result of their experience at the village. Millstone and Lang (2008) surmise that people's relationship with food is altered by innovatory food processing technologies such as a microwave oven. They add that it is necessary to know about the changing technologies that characterise the food supply in order to respond to future health and environmental challenges. The students were aware of microwave technology before the field trip to the village. After the trip to the village more students connected cooking with its roots – cooking involving direct heat.

Feedback from the post visit discussions suggests that the students learned how food was baked in the 'olden days' on older technologies that were fuelled by fire; and that this knowledge helped them with their own technological practice and their written assignments. In the findings from the discussions after the field trip students also described how it was through the village experience that they became aware of how significant traditional baking skills were to society 150 years ago and they indicated that baking skills are still important today. Mallet (2005) and Oliver (2008) believe that cooking is a dying art. Catherall (2009) however assures that it is worthwhile teaching cooking skills as they last a life time and Catherall (2009) believes that teaching children to cook can shape their eating habits for the future.

Thirteen students selected the stove as the technology to research for the assignment. Nine of these students (69%) included detailed information in their assignments about a cooking technology that was of special significance for them personally for instance the Tandoor, Umu, pizza oven. This suggests that students are disposed to explore and reflect on cooking technologies from their own culture and background (Perkins, 1993).

The focus group participants talked about the technical advances in cooking technologies that they were aware of. The students' discussion focused on tangible technical features such as switches, glass doors, oven trays, lights etc. No student mentioned 'hidden' technological developments such as the thermostat. This may relate to the students building an understanding of the technological features that were part of their everyday use of the tools – cooking technologies (Brown, Collins & Duguid 1989) and paying less attention to technological features that they were not directly involved in using.

A teaching focus could explain, as Fallon and Enig (1999) describe, a wise and loving marriage of modern industrialised foods and the nourishing traditions of our ancestors. This is consistent with the food technology curriculum objectives which invite students to engage with current and historical issues relating to food; and which encourage students to critique the impact of food technology developments on societies (MOE, 2005 & 2007). Burns (1997) adds that investigating food events in a historical setting provides a rich context for discussion and is likely to be successful because the technologies the students are exploring are removed from their personal experiences. When the social contexts of technological developments are removed from those which are accepted as the norm, students are better able to recognise the technological development, identify the people and processes that have been involved in the development, and the knowledge and techniques that have been used. Oliver (2008) too says we need to look back to the ways previous generations cooked food. Stuart (2009) adds that it is important not to let another generation grow up disconnected from their food (as cited in Barnett, 2009). From written feedback after the field trip all the students who participated in this study, felt that they learned about food and cooking technologies as a result of going on the field trip to The Historical Village. This may indicate that Burns (1997), Oliver (2008) and Stuart's (2009) recommendations for teaching and learning are sound.

5.3 Technology and society

This section of the discussion looks at the research findings and the reciprocal relationship between technology and society. It addresses the third research question which asked how a learning experience outside the classroom to a historical village on a live day helped students appreciate the complex relationship between food technologies and society.

The participants in the focus group (eight) discussed the food technologies the Fencibles left behind in England and Ireland and compared these to the food technologies provided for them on arrival in New Zealand. One student commented that regarding technological development, the Fencibles went back in time and had to use earlier cooking technologies immediately after their arrival in New Zealand. Twenty three percent of the students discussed the notion of going back in time in their assignments. The students in the focus group also commented

that the Fencibles were well aware of what might have been available for them but were flexible and able to adapt to using the earlier technologies. The students witnessed without question Basalla's (1988) notion that displaced artefacts do not disappear from the scene and for a time overlapping generations of artefacts are capable of filling the same functions. The Fencibles seamlessly reverted to cooking over an open fire (Bijker, 1992).

The students in the focus group describe a range of impacts upon the Fencible community as they moved from cooking over an open fire through to cooking using an enclosed wood burning stove. The students could, for instance, clearly imagine the opportunities created by heating water and baking at the same time. They could also describe wider consequences of increased use of developed cooking technologies such as needing to find timber to feed the fires and the impacts that this would have on the environment.

The early settlers progressed through several generations of technological development in a relatively short time frame. They experienced firsthand the process of invention and how the developing artefacts had quite a social impact. The Fencible society during this period was a conspicuous example of the continual social shaping of a technical artefact and the social impact of that artefact as described by Bijker (1992). The students in the focus group reflected on the fact that the Fencibles came to a society that was less developed than what they had come from. Diane's comment "... only came with what they needed. They needed to develop more things ... but as technology developed learning more about what else they would like ... ". Diane thought about how the early settlers managed without resources such as electricity, and compared their situation with how she experienced a power cut and could not use her hair dryer. This discussion, and similar comments from other students in the focus group, suggests that the students were able to consider the impacts of social change as Stearns (2000) intimates.

The research findings gained from the assignments and the focus group discussion suggest that the students attributed the advantages of technological developments to societies as arising from peoples' demands for convenience. The need to save time, energy, and effort were frequent comments articulated by the students in the tests, assignments (46% mentioned these factors) and the focus group (50%).

These comments are consistent with Pool (1997) who says that in the early days of a new technology the technology being cost effective and produced quickly are more important concerns for the producer than issues of safety. The students did not consider, as Kline (2003) discusses, whether time was genuinely conserved by improved technologies. The students reiterated throughout the study their observations of how long it took to cook and bake over fire. It would seem that students' first concerns regarding the advantages of a new technology would be for the technology to be more convenient in some way.

The Fencibles were smart, had knowledge and skills and required new necessities, are examples of how the students described the social factors influencing the development of technology. The students in the focus group did identify food safety and the safety of cooking technologies as being important features of food technological artefacts. They did however tend to associate these advances with more recent technologies. This is consistent with Pool's (1997) observations that safety has not been a priority during the early stages of a technological development. Two students indicated during the post trip discussion that the earlier cooking technologies had the potential to cause accidents because there was little protection from heat.

Questions on the pre and post-tests asked the students to suggest factors that prompted changes to cooking technologies over time. Students identified gas, electricity, steel, and microwaves as major changes. Responses on the post-test extended the range of responses proffered on the pre-test and included factors such as increasing population, new knowledge of science and engineering, and trialling and testing, as prompting change. Students in the focus group were able to explain why they thought societal factors impacted on the development of cooking technologies. Employment opportunities associated with a rise in manufacturing were two significant changes mentioned by students (69%) in their assignments. In the students' written documents the results of individual research included further societal impacts for instance dairying and export market opportunities. Over all the data collected there is evidence to show that students were able to identify the seesaw activity that characterises the interrelationship between technology and society. This was particularly evident in the butter assignments where students described societies changing perceptions about

margarine in accordance with new nutritional knowledge and government controls. The students demonstrated an awareness of the interrelationship between technology and society that Pacey (2001) discusses.

In the case of the Fencible settlement the producers and the consumers were from within the same community. The technological developments originated within the social context where they were to be used, and as a result of feedback from that community. Bijker (1992) says that technologies arise from within the social context where they are going to be used. The students recognised and discussed the unique combination of emigration, climate, dairying, refrigeration and a distant export market as major factors impacting on the development of food and cooking technologies and on the community.

The first research question asked: What are the benefits of taking secondary school food technology students on an interactive learning experience through a live historical village? The discussion so far highlights some benefits to food technology students arising from such a field trip. Students learned about the nature of food products and the development of cooking technologies. Students were able to explain the impacts of food and food technological developments on society.

5.4 History

This section of the discussion considers the research findings and historical thinking. It contributes further material to the first research question which asked about the benefits of taking secondary school food technology students on an interactive learning experience through a live historical village.

Feedback from discussions revealed that a number of students thought it was worthwhile to learn about the history of New Zealand visually and experience the age of the early settlers first hand. Students added that the field trip to The Historical Village showed them how their ancestors lived and cooked. One student mentioned that the field trip showed him food technologies and cooking over time. A living history museum is an engaging and effective pedagogy that pays attention to multiple facets of historical knowledge (Bain, 2005, Leinhardt, 2000). The students took advantage of multiple opportunities to make connections

between individuals and societies in the past with their society today (Boix-Mansilla, 2000).

The students in this study clearly thought that the history of food and food production technologies were relevant to their current technological practice. In their portfolios they talked about their need to know the origins of food, family traditions, past recipes and techniques in order to understand the baking processes that they had to undertake themselves. This relates to Lerner's (1997) comment when she says that through understanding history we learn how previous generations responded to the demands of their times and solved their problems.

The students, when invited to reflect on the field trip to The Historical Village, reported that they learned, not only about the history of food and cooking technologies associated with the Fencible era, but also about many other facets of community life such as gender roles, play, soldiering, education, and religion.

The Historical Village is a community near the participants' school which had the potential to yield a sense of historical empathy and positive attitudes towards history. Feedback from the students during discussion suggests that The Historical Village was an interesting and challenging setting in which to learn because as Gutierrez (2000) describes, it sets the context of learning history by manifesting the contexts of history. During the post visit discussions many students declared that the opportunity to compare their food products and kitchens with those of the Fencible community was helpful for their learning. Students also mentioned that it was helpful having the opportunity to ask questions of the village volunteer guides who were wearing period costume.

Through examining the social context of the people represented by The Historical Village, the students appreciated the circumstances that guided the Fencible settlers to construct their knowledge; and in turn the students became more aware of the nature and value of the knowledge they needed to resolve problems in the present (Morton, 2000).

Many students included historical perspectives in their writings and discussions as part of the evidence of their technological practice. Acquiring historical thinking skills is a further benefit of taking students through a historical village on live day.

5.5 Learning experiences outside the classroom

This section of the discussion considers the research findings and learning experiences outside the classroom. It addresses the first research question which asked about the benefits of taking secondary school food technology students on an interactive learning experience through a live historical village.

During the field trip that was the focus of this study the students were able to see historic technologies in action as well as interact with them preparing food products using the older tools; and baking food products over a fire or in a cast iron wood burning stove. A meta-analysis of a large body of international literature highlights the potential of learning experiences outside the classroom in a food context for encouraging students to think and learn about the origins and production of food (Kendall, Murfield, Dillon & Wilkin, 2006). On the post trip survey many of the students said that going on the field trip was a fun way to learn because of the practical nature of their experiences and because of what they saw during the visit.

The students demonstrated after the visit to The Historical Village that they were more interested in writing, for their assignments, about the baking technologies that they had interacted with while on the field trip than they were writing about later developments such as an electric stove. Falk and Dierking (2000) believe that learning is bound to the environment in which it occurs and appropriately designed exhibitions are compelling learning tools for facilitating understanding of the world.

The post trip survey also showed that the students were confident that they learned the butter making process while they were on the field trip to the village. The students commented that they had not realised that the butter making process was easy and did not take very long. It was during the field trip too that a large number of students made the connection between milking a cow and the supply of milk, cream and butter. After this awakening, students went on to describe how the knowledge of past ingredients, and processes was important for them to know before making a product of their own design. This is consistent with Breckon's (2001) comment that it is through an awareness of technology that technological knowledge and concepts can be applied. A learning experience outside the classroom is a valuable opportunity for students to appreciate the impact of

technology on the made world and how technology influences society. Students can see how things work and reflect on a specific technology's function, and impact on society and the environment (Breckon, 2001).

After the field trip the students reported that they appreciated having the opportunity to eat the food that they had prepared. The preparation, cooking and serving of food on the field trip was critical for the students understanding more about their food.

The students completed a survey later in the year, six months after the trip. The findings from this indicate that the field trip experience was still fresh in the students' minds. At this point 72 percent of the students said the field trip helped them with their assignments and 84 percent of the students said the trip benefitted them in some way. Examples of the benefits described by the students include improved understandings about history, technological development, cooking techniques, and the village artefacts, which concurs with Dierking's (2000) view that museum visitors recall aspects of a visit related to a physical context.

5.6 Summary of research findings

There are parallels between the research examined in the literature and the outcomes of this study. Academic researchers, and other writers with an interest in contemporary food issues, express concerns about peoples' lack of knowledge about the constituents of food; how food is produced; and the impact of food technological developments on society. Research also extends into the role of the school curriculum in improving students' understandings of food technology.

Prior to this study, the students demonstrated little knowledge of food composition, the sources of food, and the technologies used to produce food. By appreciating technologies used in the 19th century, the students were able to understand food, and grasp the relevance of food technologies used today together with their impact on society.

This study was a fascinating example of how history engaged the students and provided an excellent platform for enabling them to make the connection between food and technology today. Through interacting with period food technologies the students thought about technical features, community and societal impacts.

The students attributed the learning experience outside the classroom as memorable, and a fun way to learn, about aspects of food technology which were potentially challenging.

5.7 Concluding remarks

During the preparation and planning of this excursion outside the classroom I identified some barriers to the inclusion of a field trip as a class activity. General constraints include the costs to the students of transport and site entry fees; the costs to the school of relief teachers; the time required for administration of the trip such as planning, pre-site visits, and arranging permission letters etc. The negative feedback from teachers of other subjects who find having students absent from their classes is at times frustrating, and a difficult barrier to overcome. Not all teachers share the same philosophical view towards learning experiences outside the classroom.

More significantly however, for food technology teachers, is finding a food related site which relates to the teaching programme; and which welcomes visitors. It is preferable for a food technology visit to seamlessly fit in with the work students are doing in class. Occupational safety and health regulations preclude many food businesses from receiving groups of students. The challenge for teachers is matching an available site with the technological practice of the students.

The field trip that was the focus of this study was initially a standalone activity. In my school there is now a learning experience outside the classroom in year 10 as well as this year 11 trip. In the future I would like to see field trips embedded in the years 12 and 13 programmes. Students might appreciate that learning experiences outside the classroom are usual and expected activities that are part of their technological practice in food technology. Teachers of food technology, teaching across several year levels, will find it useful for teaching and learning to refer back to an experience from a previous year and look forward to one in a coming year.

There is research potential arising from situations where students have experienced food focused field trips over three or four years in succession. For instance how does each trip link to and progress from previous trips in terms of

the skills students gather.

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Appendices

Appendix A

Ethics Approval Notification

Dr Chris Eames

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Email c.eames@waikato.ac.nz

THE UNIVERSITY OF WAIKATO
Te Whare Wānanga o Waikato

To: Beatrice More
Date: 4 March 2010
From: Dr Chris Eames
Subject: Ethics Sub-committee Report on Ethics Proposal

The ethics sub-committee has considered your proposal *Food technology learning experiences outside the classroom*

The proposal as attached is approved.

Appendix B

College Principal's research consent

Research Consent Form - Principal

I have read the attached letter of information.

I understand that:

1. My school's participation in the project is voluntary.
2. I have the right to withdraw my school from the research at any time.
3. Ethical approval will be gained from the other staff, the students' caregivers and community members before collecting any data from them for this project.
4. Data may be collected from my school in the ways specified in the accompanying letter. This data will be kept confidential and securely stored.
5. Data obtained during the research project will be used for the purpose of writing reports, published papers and making presentations. This data will be reported without use of my name, the names of my staff, my students' names, the community members' names or the name of the school.
6. I can direct any questions to Beatrice Copestake

For any unresolved issues I can contact my supervisor, Dr Mike Forret at the University of Waikato (email: mforret@waikato.ac.nz tel: 07 838 4481).

I give consent for my school to be involved in the project under the conditions set out above.

Name: [redacted] PRINCIPAL

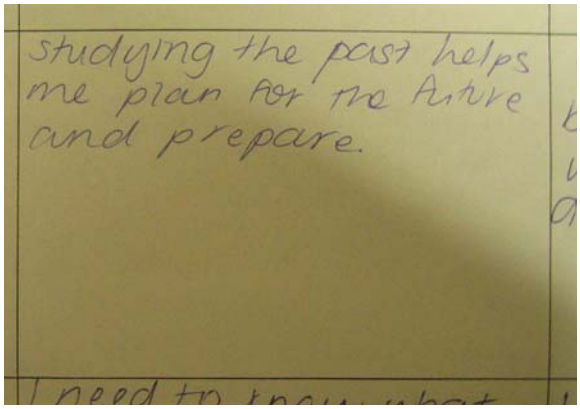
Signed: _____

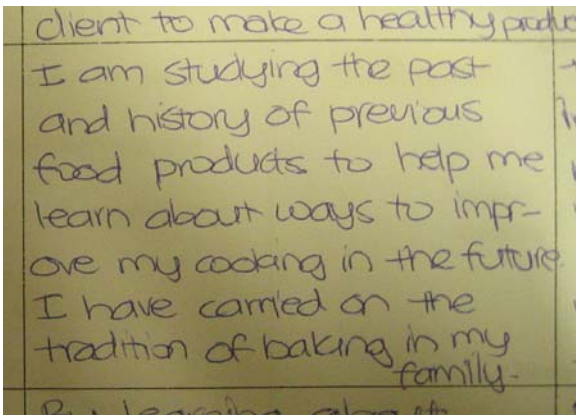
Date: _____

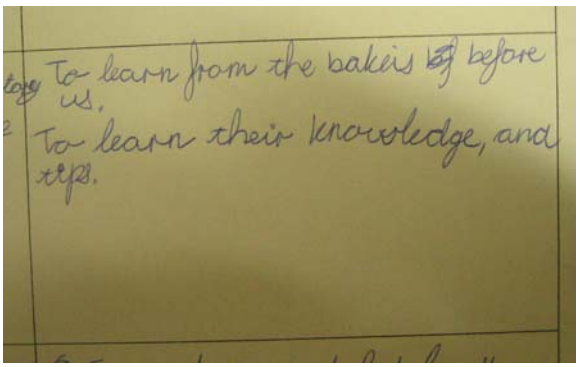
Please return to Beatrice Copestake neé More

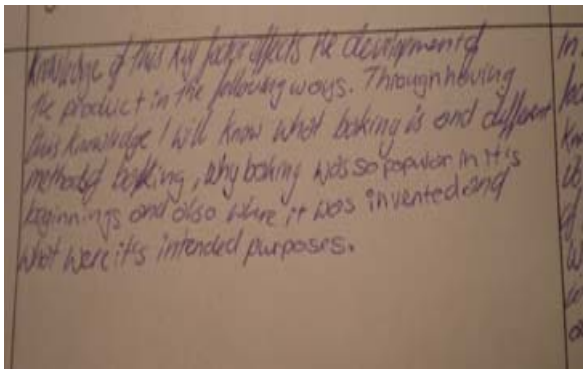
Appendix C

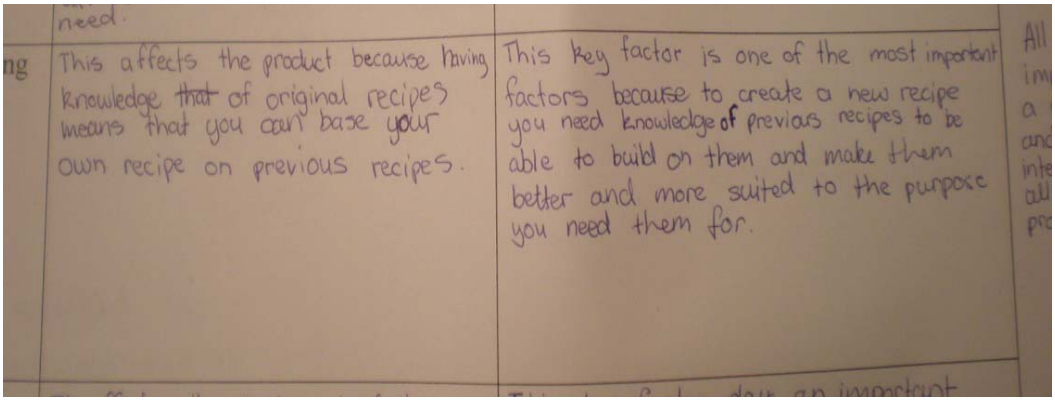
Extracts from portfolios


studying the past helps me plan for the future and prepare.


client to make a healthy produ
I am studying the past and history of previous food products to help me learn about ways to impr- ove my cooking in the future. I have carried on the tradition of baking in my family.


To learn from the bakers before us.
To learn their knowledge, and tips.


knowledge of this key factor effects the development of the product in the following ways. Through having this knowledge I will know what baking is and different methods of baking, why baking was so popular in it's beginnings and also when it was invented and what were its intended purposes.



need.

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This affects the product because having knowledge ~~that~~ of original recipes means that you can't base your own recipe on previous recipes.

This key factor is one of the most important factors because to create a new recipe you need knowledge of previous recipes to be able to build on them and make them better and more suited to the purpose you need them for.

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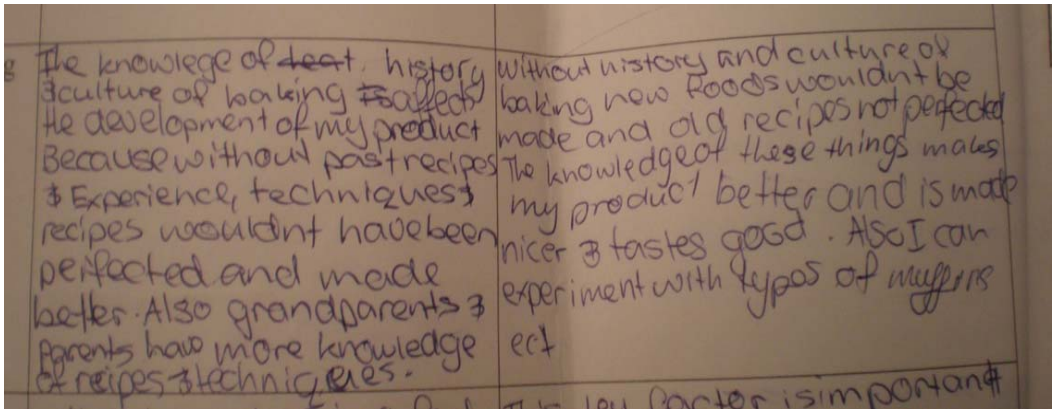

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The knowlege of ~~text~~ history &culture of baking ~~affects~~ the development of my product Because without past recipes & Experience, techniques recipes wouldnt have been perfected and made better. Also grandparents & parents have more knowledge of recipes & techniques.

without history and culture of baking new foods wouldnt be made and old recipes not perfected The knowledge of these things makes my product better and is made nicer & tastes good. Also I can experiment with types of muffins ect

This key factor is important

Appendix D

Focus Group Question Guide

1. Overall experience

Tell me about your impressions of the village experience

How was it a worthwhile experience?

How is it a worthwhile experience for a class/students learning about food and cooking?

2. Experiences with food

What food products were being prepared at the village during our visit?

What do you know about *butter* making now, that you did not know before the trip to the village?

How might this affect the way you think about *butter* next time you select it?

Looking to the future what would you like your children to know and understand about *butter* as they grow up?

To what extent did the trip to the village help you understand more about the food we eat? Explain

Thinking about *butter* – how is it different today? What are the major developments that have led to the changes in *butter*?

How is knowing and understanding more about the history of the development of a food product going to impact/help you in the future?

3. Experiences with technologies

What food production technologies were you aware of (noticed/ participated in using) at the village?

What is the purpose of an oven? How does it work?

What changes/progressions in oven technologies did you observe/notice over the 40 year period represented at the village?

What needs/wants/reasons for, were these changes meeting?

What factors influenced these changes? What was happening in the Fencible families lives at the time?

Thinking about oven technology – how are ovens different today? What are the major developments that have led to the changes in ovens?

Thinking about other food processing technologies (e.g. butter churn, grinder, wall safe) - how are they different today? What are the major developments that have led to the changes?

How is knowing and understanding more about the history and development of food production technologies likely to affect your thinking about them in the future?

4. Societal impacts

The Fencible families arrived and began settling here in Howick from around 1840 to 1880.

What kind of society did they come to?

What kind of societies did they leave behind in England and Ireland?

What societal factors influenced the new immigrants' food habits and access to food technologies, preparing and making their own food?

The development of the coal range was a significant change in oven technology for the Fencible families.

What were the key events that influenced the development of oven technologies as the Fencibles moved from cooking in a camp oven to a coal range?

What were the effects of the coal range on their lives, lifestyles and the environment?

What were the key developments in oven technologies after the coal range?

What changes happened in society that influenced the further developments in the oven?

How do you see oven technology in the future?

5. Final questions

What are the differences between your teacher telling you all about the food and food technologies during the period represented at the village and you actually visiting and doing things at the village?

How is being guided by the village volunteers, as opposed to your classroom teacher, helpful for you?

What are the key factors about the village guides that made the difference?

What improvements to this village experience would you recommend for next year's students?

Appendix E

Post field trip survey

_____ Historical Village – Feedback Name: _____

What were the highlights of this field trip for you - generally?

What did you learn about making butter?

How was the field trip a good way to learn about food production?

What did you learn about methods of cooking (heat)?

How was the field trip a good way to learn about the development of cooking over time?

How was going on a field trip a better way of learning about food technologies than just having the teacher talking about it in class?

Appendix F

End of year survey

village logo

Name:

Now that 1.7 is all over, looking back, how did the _HV trip help you with your assignment

The trip **outside the classroom** and learning about the impact of changes in society and developments in butter and/or ovens

In what ways did going on the field trip to the _HV earlier in the year help you with your 1.7 assignment?

How did experiencing a snapshot of daily life in NZ around the 1840s help you understand that technologies change because developments/things in society change?

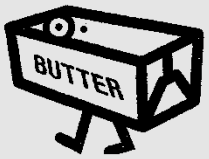
How did experiencing a snapshot of daily life in NZ around the 1840s help you understand that people change/do things differently when a changed or new technology develops?

What would be the advantages of taking next year's year 11 classes on the trip to the village?

Appendix G

Assignment exemplar

Achievment Standard 90051: Technology 1.7



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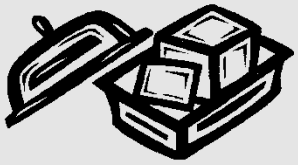


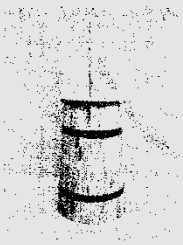
Introduction

As part of our study of technological innovations and society, I researched the life and times in Howick during 1840-1880.This is the historical period shown at the [ ] Historical Village. The Fencibles were retired British and Irish soldiers. They had come down to New Zealand to act as a defence force to protect the early settlers of New Zealand from any threats that arose. Howick was the perfect area for settlement of the Fencibles. This was because it was virtually uninhabited, apart from the local Maori in Cockle Bay. This provided a place for the Fencibles to start totally fresh; exactly what majority of them had come here to do. Being surrounded by the beach provided a place to get food for the Fencibles and their families. The local Maori would have also helped in the providing of vegetables and possible some meats. Howick of the present day has been shaped by the Fencibles by way of turning it from a whole lot of empty land into a bustling town with many small businesses. They have also left their mark in Howick by having streets named after Fencibles such as; Fencibles Drive, Bacot Road and Walter MacDonald Street. The technological innovation I have chosen for this assignment is butter. I chose butter because New Zealand's early settlers were very dependent on baked food in order to feed their families and entertain guests. Baked products have many different ingredients, butter being one of the main ingredients in most baked products. This year in food technology we are focusing on baking skills and will be designing and producing our own baked snack food. Baking is an old and important skill to have. Butter has undergone huge developments and changes in its 150 year history in New Zealand, changes in society have also influenced its changes.

For the early settlers of Howick an important innovation was butter and it remains to be an important food product in today's society. Butter as we know it today only came to be through undergoing many changes through its 150 year history. Butter is an edible, fatty whitish yellow solid made from cream, which is separated from whole milk. This milk mainly comes from dairy cows but can also come from goats or ewes. Butter is made using many different processes such as whipping and churning. This is how to make butter by in the olden days by churning; 1. Milk the cow 2. Put the milk into a large bowl,

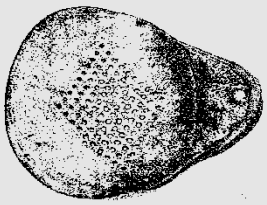
cover with cloth and leave in a cool place for a few days. 3. Take the bowl out of the cool place uncover and using a large spoon or skimmer to skim the cream off the top and set it aside in a separated jar or bowl. Repeat processes 1 through 3 until the desired amount of butter has been accumulated. 4. When the desired amount of cream has been accumulated poor the cream into the churn move the dasher(the part of the churn that looks like a big stick, sticking out of the middle of the churn) up and down until the cream has separated into butter and buttermilk. 5. Remove the chunks of butter from the butter milk. Add salt to the butter as desired. Now you have butter.

The equipment and recourses required to make butter in the 'olden days' included; cows, churns, smaller hand churns, skimmers, shallow metal bowls and salt.



Churn

Hand Churn



Skimmer

Butter has changed in New Zealand a lot over the past 150 years. The introduction of Dairy Cows to New Zealand has aided in this change. In the beginning Dairy cows provided milk for not only the production of butter but; whole milk for drinking and making cheese for use mostly within New Zealand, but some was used for exportation. At the time it also provided work for women and girls and income for families, but was threatened by margarine in 1869 caused the butter industry to lose money as margarine was a cheaper alternative to butter. It was also believed that butter had many nutritional benefits. Now butter and other products of the dairy industry are major export products and are a major source of income for New Zealand's economy. The negative nutritional aspects of butter were discovered in the 1980's which allowed margarines to become more popular as they were proven to be healthier than butter. Butter is high in fats such as cholesterol making it's consumption a health issue, in New Zealand 40 percent of deaths are caused by cardiovascular disease, which is caused by the consumption of too much high cholesterol foods. People now know much more about Green House Gases. One such gas is Carbon Dioxide Gas, it is emitted by cows, and this contributes to global warming as the mass emission of these gases into the earth's atmosphere is said to be the leading cause of Global Warming. Cows are the main source of milk to produce butter making this is a huge issue within butter's production. In future butter will continue to be a health issue for New Zealander's, but one day a technological advance could lead to the production of cholesterol free butter and the genetic modification of cows to make them produce very little or even no Carbon Dioxide emissions. Butter has also undergone many changes as New Zealand has become more urbanised. Originally butter would be produced in a family kitchen with manual churns, for consumption by that family and possibly some to sell at the local market, then it and other dairy products such as milk and cheese were produced in small factories commercially for exportation to mostly Australia

and /or England and for sale across New Zealand and today dairy products are produced in industrial factories to be sold in New Zealand and to be exported all across the world.

As society in New Zealand has changed the need for butter and other dairy products as export products and for used within New Zealand grew, the ways in which they are used have changed; as a result the need for dairy cows has increased. Native bush was turned into farmland to make the space for the growing amount of dairy cows; this has created lots more work opportunities for new settlers and already established New Zealanders, not only within the farming sector but also within the production sector. This has also helped establish New Zealand as a world renowned dairy exporting nation. Today many positives have come out of this, but there has also been a negative effect of this. The positives have been; it has created many jobs for New Zealanders within the dairy industry leading to the creation lots of dairy products for us here in New Zealand and as export products, the negative effect was that the clearing of the bush made the land less stable, causing landslides. This will sometimes make it unsafe for farming use resulting in there being less farmland for the dairy cows. In the future it is more than likely that butter and other dairy products will have to compete with 'dairy products' that are lactose free, new healthier butter alternatives will become available as well as margarine and they will have a greater demand in the market adding to the competition. These not only being competitors in the area of their use as spreads, but could also cause butter to be less commonly used in baked products as well. How society views butter has changed a lot over the years. It has gone from being viewed as a status food that is vastly important to society to today being viewed as a staple food not necessarily essential for survival which is viewed as a less important food by society. In future the way in which butter is viewed will vastly differ as new and improved butter alternatives are inevitable and these could prove more popular than butter. Even butter itself could change only time can tell.

Butter has been a successful innovation as it has provided food and income for New Zealanders and others worldwide. We know this as it has become a major export product providing a large percentage of the New Zealand economies income from exportation. Butter has been proven a less successful innovation at the introduction of margarine to the market. This is because margarine was a cheaper alternative to butter; margarine is easier to spread and has been found to be a healthier alternative to butter as well.