Teacher responses to a planning framework for junior technology classes learning outside the classroom

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Abstract
This paper describes teacher responses to a framework designed to support teacher planning for technology. It includes a learning experience outside the classroom [LEOTC] and is designed specifically for five-year-old students. The planning framework draws together characteristics of technology education, junior primary classrooms and LEOTC to describe the role of the teacher, parent helpers and students as they work through three identified phases – preparing for a visit outside the classroom, participating in a learning experience outside the classroom, and post-visit activities in the classroom. This framework was trialled using a case study approach in two new-entrant classrooms in which students made chocolates for Mothers' Day as part of a technology unit. Students partook in a LEOTC visit to a chocolate factory in order to examine the practice of experts before designing and making their own chocolate gift. Data sources for this paper included interviews with two participating teachers. The analysis of these suggest the use of the planning framework led to the thorough preparation of parent helpers and students, clearly defined roles for both the teachers and the parents, and the use of valuable strategies which enhanced students memories of their visit and enabled them to apply aspects of the knowledge gained to their own technological practice.

Key words
technology education, five-year-old students, LEOTC (Learning experiences outside the classroom), planning framework, case study

Introduction

The value of students experiencing learning opportunities outside the classroom (LEOTC) is well documented (e.g., Anderson, Thomas and Ellenbogen, 2003; Rennie and McClafferty, 1996). Whilst there is research reporting on LEOTC in science (Bolstad, 2000; Dierking, Falk, Rennie, Anderson and Ellenbogen, 2003; Tofield, Coll, Vyle and Bolstad, 2003), we have found no previous studies which explore the experiences of junior primary students in technology. In spite of this apparent dearth in the literature, the practice of taking students on out-of-school visits is a fundamental part of New Zealand schooling. It therefore seems important to understand how this can enhance learning opportunities, particularly in the current educational climate when allocation of funding for LEOTC in schools is both restricted and outcome-driven by principals endeavouring to rein in escalating running costs.

This paper describes teacher responses to a framework designed to support teacher planning for technology education incorporating LEOTC with junior primary students. The framework is presented along with data regarding the teacher responses to the planning and use of the framework, gathered during an evaluation of the implementation of the framework in two schools. The research question addressed in this paper is: How do teachers respond to the planning framework for technology education incorporating LEOTC with junior primary students?

Context for the study

In New Zealand, children begin school on their fifth birthday. Two classes of these students, along with their teachers and parent helpers, were invited to participate in the study. One class of students was from a city school with a roll of approximately 600 students and the other was an eight-teacher country school with a roll of 200 students. The classes were studying a food technology unit in which they were to design and make chocolates for a Mothers' Day gift. A visit to a local chocolate factory was included as part of this unit during which students would observe displays of different types of chocolate confectionery and the ingredients and equipment required for making chocolate, have the opportunity to taste chocolate, see expert chocolate makers in action and generally absorb the sights, smells and sounds of production.

We begin with a review of literature exploring technology education in the New Zealand curriculum, LEOTC and the learning needs of five-year-old students to provide the background from which the planning framework was developed.

Key ideas underpinning the planning framework

Technology Education

Emerging from an extensive curriculum review project during 2002, a revision of the technology curriculum was undertaken as part of a completely revised New Zealand Curriculum in 2007 (Ministry of Education [MoE], 2007). The new curriculum has three technology education strands: technological practice, technological knowledge and the nature of technology. *Technological practice* includes students studying the practice of others and gaining expert advice before planning and carrying out their own practice or product development. The *technological knowledge* strand includes components of

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knowledge which are generic to all technological areas and contexts, for example, the performance properties of materials, the make-up of technological systems and the use of functional modelling. The *nature of technology* strand aims to provide "opportunity for students to develop a philosophical understanding of technology, including how it is different from other domains of human activity" (Compton, Keith and Dinning, 2007, p. 12). These three strands come together to develop students' overall technological literacy, that is, the development of knowledge and skills relating to the principles and processes of technology, the ability to select appropriate materials and design solutions, and understanding technology as a human endeavour and a domain in its own right (MoE, 2007).

Learning experiences outside the classroom

The positioning of LEOTC in New Zealand schools is fundamental to this study. It is both recognised and valued by the teaching community (Moreland, McGee, Jones, Milne, Donaghy and Miller, 2005) and is supported by the Ministry of Education (MoE, 2011).

Funding by the Ministry of Education is for specific providers offering learning experiences which extend beyond the four walls of the classroom and typically beyond the school grounds (MoE, 2010). The philosophy is that LEOTC programmes need to complement students' in-school learning and provide experiences that could not be made available in the normal school environment (Te Kete Ipurangi [TKI], 2011). Recommendations for LEOTC of particular significance to this study advocate for activities that are relevant, hands-on, interactive, and enhance and enrich the New Zealand school curriculum. Crucially, learning goals should be clearly identified and visits should be part of a more extensive classroom unit of work rather than a one-off activity. Preparation and follow-up to visits are vital in fulfilling the goals of all LEOTC programmes (MoE, 2007).

The range of established LEOTC sites funded by the Ministry of Education for technology education in New Zealand is limited, possibly due to the relatively recent inclusion of technology education into the New Zealand Curriculum. The focus of existing sites also tends to be on technological artefacts rather than technological practice. We reasoned that rather than be constrained by the limitations of these government-funded sites, we should look to other industry-based sites that provide access to the general public and that demonstrate the 'expert practice' sought by the technology curriculum. In addition, there is no current evidence to suggest that existing LEOTC programmes presented by Education Officers at government-funded sites adequately scaffold the technology education curriculum. It is hoped that the findings from this study may provide some insights into LEOTC programming that enhances technology education.

The learning needs of five-year-old students in LEOTC

There are inherent difficulties when planning to take five-year-old students out of the classroom on a LEOTC visit. A high priority is managing the children's physical needs in order to reduce stress or anxiety that may be experienced by the children or supervising adults, for example, allowing time for the children to use toilets, provision of refreshments prior to beginning the learning activity and anticipating problems which may emerge as a result of the children being confined in a non-school controlled space for a lengthy period. To accommodate these needs, a 'comfort' stop before and after the visit can be timetabled; an interruption to the flow of the visit, in this case to a factory site, because of a need to backtrack to a restroom would create a disturbance for groups following the children and could also result in important 'snippets' of information being missed. 'Hunger pangs' could offer another challenge that can distract young children from attention to the learning milieu, and was particularly relevant in this study where children would be viewing the displays in the chocolate factory shop. To avoid the potential of this distraction, time for a sizeable morning tea beforehand was created. In addition, several studies have found a positive relationship between increased physical activity and concentration (e.g., Bailey, Armour, Kirk, Jess, Pickup and Sandford, 2009). In response to this, children were encouraged to take a break after morning tea and play outside for a short time (Wineman, Piper and Maple, 1996).

Site selection is another key consideration when planning a visit outside the classroom, and there are a number of elements of this that can help facilitate students' engagement in the learning opportunities offered. For example, Anderson (2003) alludes to the importance of 'matching' the experience to the social-cultural world of the visitor. Falk and Balling (1982) advocate settings of 'appropriate novelty' that are new and exciting for students and that are easily remembered. In addition, they argue that irrelevant stimuli or distractions may interfere with some students' attention, so a site being visited by young children which has a single display or focus could offer a more worthwhile and focused learning environment.

Most five-year-old children have a much shorter concentration span than the adults accompanying them on out-of-school visits (Boyden and Ennew, 1997). The likelihood of distractions during a LEOTC visit will be high

and, in the case of a chocolate factory, there was an extensive, colourful and mouthwatering array of chocolate and confectionery on display, there were other visitors at the site, and the prospect of a morning away from school with the parents meant that the children's level of excitement was greater than usual. These extra dimensions of the learning experience have the potential to limit students' focus if they are not considered during the planning phase.

A further consideration in the selection of an appropriate site is identifying and managing risk. In New Zealand this is deemed to be a dual responsibility on the part of the visiting school and the site management. This usually involves identifying hazards, assessing the significance of the hazard, eliminating the hazard if possible and if not, isolating or minimising the risk to students (MoE, 1998). A school hazard register is provided by the Ministry of Education and schools are encouraged to complete a detailed evaluation document prior to any visit outside the school grounds.

The inclusion of hands-on experiences during a site visit can be very satisfying for a visitor (Tully and Lucas, 1991) and the value of handling objects as part of a concrete experience has long been advocated (Hall, 1981; MacKintosh, 1998). The sensory experience of a child when he/she encounters the smells, tastes and feel of an object is a 'direct personal experience' (Hall, 1981) rather than an experience which has been merely described. Bloom's taxonomy of educational objectives (Bloom and Krathwohl, 1956) also places high value on the concept of exploring and working with objects – an opportunity which Cohen (1987) suggests makes experiences real and easy to understand. The selection of the chocolate-making factory as the site for this visit met many of these requirements – the sensory experiences of the retail shop; the smells, colours and textures of the displays; and the kinesthetic experience of making chocolates and lollipops – not to mention the taste testing!

Learning is based on children's previous experiences and their understanding of the environment of which they are a part (Rennie and Johnson, 2004). As Falk and Dierking (1997) note, it "is the process of applying prior knowledge and experience to new experiences: this effort is normally played out within a physical context and is mediated in the actions of other individuals" (p. 216). This social constructivist view of learning which "recognises an individual's prior knowledge and personal active involvement in knowledge construction" (Mintzes and Wandersee, 1998, p. 52), along with a cognitive apprenticeship model in which learning takes place alongside experts (Rogoff, 1991), provides a useful framework for considering the learning process undertaken during the visit. The knowledge children bring to the factory visit experience will likely impact on their ability to understand and participate, and pre-visit preparation should include an assessment of what the students already know, in this case about chocolate and chocolate making, along with the provision of time to familiarise them with the ingredients, equipment and processes involved in chocolate making. As language is key to mediating learning (Vygotsky, 1978), understanding and using the language is to be part of the experience. In this case, understanding processes such as melting, hardening, mixing, and the names of the tools and ingredients, would enable children to access the tools of the dialogue and the demonstrations that would take place during their visit. It was anticipated that this would also enable them to comment on and think about (Verillon, 2009) the objects and processes of chocolate-making as they may apply to the design of their chocolate gift for Mothers' Day.

Anderson (2003) has argued that visitors' memories of a world expo exhibition were significantly influenced by the socio-cultural identity of the sightseer at the time of the visit. Similarly, the socio-cultural identity of five-year-old students attending a LEOTC visit would clearly influence what attracts their attention, what they notice as being important, and what they remember; 'the lens' through which they view the visit may be very different from that of the accompanying adults. This suggests that supervising parents need to mediate and help connect students to aspects of their visit that, because of their age and socio-cultural background, may be ignored. In a paper exploring docent-led guided school tours at a museum (Cox-Peterson, Marsh, Kisiel and Melber, 2003), focusing questions and activities were seen to assist in making connections between the formal (science) curriculum and the artefacts of the exhibition. This was identified as a key factor in achieving the intended learning of a LEOTC visit and in our study, prior to the chocolate factory visit, parents were provided with a description of the purpose of the visit, the learning intentions, and a series of linking questions on cards that they were asked to put to the students as they moved through the retail shop, the chocolate-making demonstration and the lollipop-making demonstration. In this way it was hoped to establish clear links between the displays, demonstrations and the learning goals of the visit.

A significant influence on students' engagement with the planned learning experiences of the visit seems to be their "motivation and agenda" (Anderson, 2003, p. 145). For

example, in the world expo research project, visitors who had a particular reason for visiting an exhibition had better recall of what they had seen afterwards than those who didn't (Anderson, 2003). Lambert and Balderstone (2000, p. 243) referred to this type of motivation as the "need to know" element of a visit and this was a significant driver in planning the chocolate factory visit. By preparing a set of questions to be answered during the visit, students would also address the requirements of the curriculum's technological practice strand in which opportunities should be provided for them to "examine the practice of others and undertake their own" (MoE, 2007, p. 32). If students attend a visit with a curiosity and desire for information, the degree to which they engage with exhibits should be heightened (Sandifer, 2003).

A junior primary classroom teacher with a strong pedagogical background brings extensive knowledge and experience to a task such as a LEOTC visit. The same assumption cannot be made of parents who offer to help transport and supervise students during a visit; a group whose availability and goodwill naturally carry huge importance when taking children outside the classroom. However, our experience as educators suggests that this group of adults generally offer to help because they want to share the visit experience with their children, or they want to participate in the experience themselves, and not because they bring any particular skill or knowledge to the task. It can therefore be difficult for teachers to anticipate parents' ability to carry out the role expected of them as the 'parent helper'. For this reason, assumptions cannot be made about their existing knowledge of the context of the visit or their ability to work effectively with young children, and every effort must be made to ensure that they are 'up to speed' for both the parents' own satisfaction and in order to optimise the children's learning opportunities. The role of the parent helper can be likened to that of the teacher aide, in whom considerable trust and teaching responsibility is bestowed, but often with the provision of little training or guidance. Consequently, to enable parent helpers to participate effectively in a visit, provision of all relevant information, organised meetings and support given during the visit must be timetabled.

Description of the planning framework and implementation

In response to the dearth of reported studies exploring technology education experiences outside the classroom, a planning framework was developed to guide a teaching and learning intervention incorporating a LEOTC visit to a chocolate factory in two classes of five-year-old students, as shown in Table 1. This framework draws on learning ideas inherent in the technology learning area of the New Zealand Curriculum (MoE, 2007) and relevant literature pertaining to this domain, as well as conceptions of successful learning experiences outside the classroom. By incorporating elements of teaching and learning within each of these learning domains, and presupposing that a combination of these domains required, guidance is provided for purposeful planning of a technology task before, during and after a LEOTC.

<table>
<tr><th colspan="7">Planning and teaching sequence</th></tr>
<tr><td>LEOTC</td><td rowspan="2">Teacher planning and preparation</td><td>Liaise with and prepare parents for their role in the visit</td><td>Prepare students for visit</td><td rowspan="2">Visit to factory</td><td rowspan="2">Follow up to factory visit</td><td colspan="3">Connect final three phases to students' knowledge gained during the factory visit</td></tr>
<tr><td>Technology</td><td>Liaise with and prepare parents for their role in the technology tasks</td><td>Prepare students for technology task</td><td>Facilitate market research and design process</td><td>Facilitate chocolate making process</td><td>Facilitate review and reflection of design and construction process</td></tr>
<tr><td>Weeks</td><td>1-2</td><td>3</td><td colspan="2">4</td><td colspan="3">5</td></tr>
</table>

Table 1. Model of planning merger between LEOTC and Technology Education

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Table 2 presents the customised planning framework developed in this study, divided into the following components:
- Considerations for planning and teaching technology;
- Considerations for planning the learning experience outside the classroom; and
- The role of other 'players' within the unit and visit.

Each of these components is planned for the three phases of the unit; before the visit, during the visit and after the visit.

The involvement of parents was a critical element in this study. A first contact was made by sending a description of the visit and its purpose to the parents of all students going on the factory visit, along with a request for help from those who would be available. Parents were also informed about the nature of the research project. Those who offered to attend as parent helpers were subsequently provided with a detailed explanation of the intended learning goals of both the visit and the curriculum area in which the visit was to be embedded. A final communication on the morning of the visit described the role they were to carry out, along with a list of questions and prompts that they were encouraged to put to the children as they progressed through the factory.

Research design

Rose and Hannah, pseudonyms for the participating teachers, met with the researcher on three occasions. Two meetings were held to introduce the research and to share ideas on how to frame up the technology unit and the visit. These discussions were audio recorded and were used to establish the teachers' prior knowledge of LEOTC and technology education, as well as creating an opportunity for the teachers to actively participate in the decision making and planning stages of the technology

	Technology education	LEOTC	Role of others
1. BEFORE THE VISIT	• Select a context for study which is relevant and familiar to the world of the students, that is, making chocolates for Mothers' Day • Discuss idea of creating a gift for Mothers' Day and guide students towards making chocolates • Negotiate a plan with students which will describe how they can achieve making their chocolate gift – including visit to factory • Identify students' prior knowledge of the technological process involved in making chocolates • Establish student familiarity with the language of chocolate making • Establish a 'need to know' context to drive the unit and the factory visit • Identify clear learning goals and effective assessment strategies which reflect The New Zealand Curriculum • Negotiate attributes of the chocolates with students • Locate resources to support teaching activities	• Identify students' prior knowledge of making chocolate and build upon this before the visit • Select a novel, relevant, real world and age • Plan to include focused pre and post visit activities • Select focused experiences from which students can gather information to inform their individual projects establishing a 'need to know' context • Be knowledgeable about the site and what it has to offer • Meet with parent helpers – share teaching goals and provide hand-out to indicate responsibilities during visit • Appropriate experience for students • Ensure visit is short, focused and free of unnecessary distractions • Ensure visit includes hands-on exhibits and experiences • Ensure availability of toilet facilities and refreshment areas • Meet with site staff to share learning goals of visit and discuss appropriate teaching level for the presentation	*Parent helpers* • Understand the purpose of the visit and the teaching goals • Understand that the tasks they have been asked to carry out are designed and selected from previous research and the literature of LEOTC • Ensure familiarity with the schedule of the visit including time for refreshments, toilet visits and when purchases from the site retail outlet would be most appropriate

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	Technology education	LEOTC	Role of others
2. DURING THE VISIT	• Ensure students find out how to achieve their goal of making chocolates gifts by asking prepared questions during the chocolate making demonstration • Prompt students to keep in mind the 'need to know' aspect of their visit • Encourage students to participate in opportunities to make chocolates and lollipops • Guide /prompt parents to use the correct language associated with chocolate making along with the ingredients and equipment used when speaking with the students • Prompt parents to constantly interpret the observations they make during the visit • Ensure the learning intentions drawn from the technology curriculum are addressed e.g. material properties and production systems	• Oversee visit – managing start and finish times and general movement through the factory –the teacher should not supervise a group themselves • Observe student/parent interactions and their engagement with the site and its exhibits • Provide back-up for parents ensuring students behave appropriately and maintain a focus on the planned tasks • Prompt and encourage parent helpers in carrying out their tasks • Support and prompt student questions • Record visit with digital camera (or other) and collect samples for use during follow-up activities	• Supervise and work with a small group of students • Follow teacher guidelines, that is: ° talk to the children about learning goals ° interpret presentations and products being viewed ° present/reinforce correct names of items and processes as children view the products and demonstrations • Draw students' attention to the products and exhibits relevant to their study

	Technology education	LEOTC	Role of others
3. FOLLOW-UP TO THE VISIT	• Facilitate discussions regarding the goals of the visit • Provide opportunities for students to draw and record key aspects of the visit • Review language associated with the visit, that is names of products, ingredients, equipment • Discuss the processes involved in chocolate making to ensure a shared understanding and to facilitate transfer of information into students' own practice • Discuss and sequence the production process by viewing photographs of the visit • Review information gathered to enable students to make their own chocolate • Review the planning steps required to make the chocolate gifts, based on the factory visit • Introduce idea of gathering information through a simple questionnaire • Introduce idea of planning/testing chocolate shapes through modeling with clay • Provide venue, ingredients and supervisors to assist students in making their chocolate gift	• Plan follow-up activities to help cement students' memories and understandings of the experience • Facilitate a detailed review/recount of the visit • Present follow-up activities directly after the visit e.g. include activities such as imaging, drawing, discussion, viewing photographs and sequencing the production process • Continue to signal the purpose of the visit and how students will use the information gathered	Supervise chocolate making using students designs, planning frameworks and questionnaire information

Table 2. Planning a technology learning experience outside the classroom for five-year-old students in which they visit a chocolate factory

unit. This co-participation allowed teacher input to the framework described above. Semi structured interviews were held a few days after the unit had been completed to determine the teachers' views of the value of the framework, and its use in planning a technology unit. Data gathered pertained to four main categories including preparing for the visit; parent, teacher and host staff roles during the visit; post-visit activities and the student learning outcomes from the unit as a whole. Analysis was carried out by thematic coding using the framework as a guide and the main features of this analysis are reported below.

Teacher responses to the framework

Before the visit

Several themes emerged from the data analysis pertaining to the teachers' preparation of the unit. These included the clarity of information and instructions given to parents, the importance of students acquiring language that would enable them to readily engage with the experience, the choice of LEOTC site, and safety considerations for all participants. The first of these themes is particularly relevant to this paper and is described below.

The process of preparing parent helpers was a key element of the planning framework. Prior to the commencement of the technology unit, each parent in the class received a letter inviting them to supervise a group of students during the factory visit, as well as an explanation of the research which was going to track students' work before, during and after the visit. On the morning of the visit, the parents who volunteered their help were invited to attend a meeting in which the researcher explained the goals of the visit and details of the role they were to carry out. They were provided with an information card which listed questions they were encouraged to ask the students and the language associated with the chocolate making process that they could reinforce. They were also asked to draw students' attention during the visit to items that highlighted aspects of technological practice such as the chocolate moulds, colourings, flavourings and the vast range of chocolates which were on display.

The teachers, Rose and Hannah, both commented on the thorough preparation of the parent helpers prior to the visit. They recognised the value of parents being fully informed about their role during the visit and the intended learning goals and expected outcomes of the technology unit. For example, Rose reported:

> I think it was made quite clear that it wasn't just an entertainment, we were going out there because we were going to do the process. The card you [the researcher] gave them made it quite clear what they needed to be pointing out, and actually when we walked through the shop part before we went in I thought they did a really good job, they were really talking to the kids.

During the visit

The themes which emerged from the teacher response to the planning framework regarding the actual visit included teachers having an oversight of children and parents during the factory visit rather than supervising one particular group of students, the advantage of having a single teaching and learning focus during the visit, the value of hands-on experiences and the importance of children viewing all elements of the chocolate making process.

The visit for the students began with morning tea and a short play in the picnic area. This was followed with a walk through the retail section of the factory and an opportunity to identify ingredients and equipment and discuss the wide range of chocolates on display. The students were then ushered into a chocolate making demonstration where they learnt about the chocolate making process in the factory as well as having an opportunity to make their own chocolate fish – a simple task of pouring melted chocolate into trays of small fish moulds. The visit finished with a second demonstration during which they were shown how to make lollipops and boiled sweets.

Being free to oversee the visit, rather than supervise the children, was recognised as a real advantage by both Hannah and Rose. It allowed them to gather a photographic record of each phase of the visit, to unobtrusively 'trouble shoot' if the need arose and to observe how well the allocated parent roles were being carried out. Hannah reflected that "I managed to take some really good photos; that was important to me to be free to do that, and just observing how they [the children] were coping with the whole experience really". Rose agreed:

> I think I just saw my role as overseeing the whole experience and making sure that the children got as much out of it as possible, so to that effect I…well, people who talk to children sometimes are not trained obviously to do that and sometimes they can talk above their heads so sometimes you need to reinterpret what they say or reword it for the children so they can understand it.

The follow-up activity, which students did on their return to school, was to write about and illustrate something they had learned at the chocolate factory. The children all drew pictures of the 'hands-on' experiences they had of either making a chocolate fish or a lollipop. Rose considered this

to be the result of having gone to the factory with a 'need to know' desire. It also signaled to her the advantage of young students having hands-on experiences during a LEOTC experience. Rose described the follow-up lesson taken by her support teacher:

> Amanda, the other teacher, talked to the children about what they did; they wrote a story about the best thing at the chocolate factory or the best…what they'd learned or something like that, and most of – virtually all of the children – wrote about the chocolate, the making of the chocolate. And they didn't have to, so that was – I was pleased about that because that was the main focus.

The relationship between observing a process and understanding it was recognised by both teachers as an important element in young students' conceptions of technological practice – the practice of experts in the development of a product. Being able to observe all phases of the chocolate making process was critical. For example, it was observed that after the children poured melted chocolate into fish moulds, the factory host placed the fish on a small conveyer belt which then moved the fish out of sight. He explained that the conveyer belt took the fish through a cooling tunnel so they could harden before staff wrapped them and returned them to the children. Despite a reasonably clear explanation of this, most of the children failed to understand what had happened to the fish between the time of pouring the chocolate and receiving the wrapped parcels. Hannah described how she felt:

> I think the only thing they missed out there was that the kids didn't understand that step about them going off to be cooled, you know cool the mould, they didn't, after they'd spooned their chocolate in they didn't really know what happened, they didn't know that it popped out of the mould, you know it was chilled and then it was popped out, it was just one step that they didn't seem to pick up when they were talking about.

Early in the planning phase, the teachers commented on the importance of having a short, focused visit for their five-year-old students and whilst the teachers and researcher had control over the timing of the visit, control of the presentations had to be negotiated with the factory staff. As a result the chocolate making presentation was extended and the lollipop making, which was the main feature of the factory presentation for the public, was kept as is. Rose had some misgivings about this dual focus:

> I'm pleased that the factory agreed to do the chocolate [making] and in some ways although the factory does do the lollipop and the children were into watching that, I feel that it diverted a little bit of the children's attention away from the chocolate, which was our main focus. So probably if I was to do it again I would say we'll just watch the chocolate and leave off the lollipops.

Follow-up to the visit

The themes that emerged from the teacher response to the post-visit planning framework included collecting a photographic record, which offered opportunities for students to review and reflect on the visit; problems associated with handing over phases of student supervision to parents when they are not fully conversant with the teaching and learning goals of the unit; and that surveying parents is a valuable opportunity for students to use a skill from the mathematics curriculum in a real context. The first two of these themes were emphasised by the participating teachers in their reflections on the planning framework.

Follow-up classroom activities included a review and reflection of the factory visit by the students and their teacher, a re-focusing on the students' own chocolate making task, a questionnaire about chocolate preferences that was completed by the students' mothers, model making of a chocolate (which reflected information gathered in the questionnaire) and finally construction of their chocolate gift for Mothers' Day.

A phase of the unit which also required parent help was during follow-up activities when the students created their chocolate gift. These activities did not always involve the same parents who went on the visit. An outcome which wasn't anticipated occurred in Hannah's classroom, when a group of parents who hadn't attended the visit participated in the chocolate making activity. Having missed out on the more focused preparation of helpers prior to the visit, they seemed less aware of the teaching and learning goals and, in fact, altered the chocolate making task. Hannah reported that, "I think a couple of mothers have said 'right you're making one for mum and you can make one for yourself'." It was observed by the researcher that this significantly impacted on the task focus of some children, who appeared to disregard the survey they had completed with their mothers about their chocolate preferences, and instead selected flavours and fillings of their own preference.

In developing a teaching plan for the unit informed by the planning framework, Rose and Hannah incorporated a range of strategies designed to support their students' learning. These included strategies which would ensure that each phase of the visit was clearly understood by the students, and that the new language of chocolate making was understood and able to be used. Recording photographic evidence during the site visit was one

strategy employed by the teachers. By presenting images of the visit to the children directly afterwards, the children were able to revisit, analyse and review their experiences. Hannah made the following observation:

> I think actually that reviewing the photos put them right back, you know when we were talking about it the next day, they could see, they were right back in that situation again. So the photos, going back to photos very regularly was a good way to put them right back in that context. So that was a very successful thing to do.

The process of product development within technology education provides opportunities for students to apply skills identified in other curriculum areas into a real context; in this case there was the opportunity for the students to carry out a survey with their mothers about the chocolate flavours and fillings they preferred, to discuss the results in class and to use the information when designing their chocolate gift. This was recognised and commented on by Hannah:

> I think doing the surveys was great because in statistics, we've done a lot of gathering of information and they had to go round with a survey sheet and get tally marks – 'favourite colours, my friend's favourite number'…so that the survey that they sent home with their mum, [and the tasting], that was actually asking them their opinion, it was giving them [the students] some power that they can go round and find information and do something with it.

The aim of the New Zealand technology curriculum is for students to develop a broad technological literacy that will equip them to participate in society as informed citizens. Hannah was very heartened by how the unit had helped achieved this, encapsulating her view of technological literacy and student empowerment in a final comment she made when reflecting on the learning opportunities gained during the chocolate-making unit and factory visit:

> …it's [technology education] to give the kids the sense that there are all these things that happen out there in the world but 'I can actually do some of it, I have some power, I have some expertise' – yeah, just because you're a little kid you're not just a bystander, you can actually play an active role and plan and decide, and make decisions.

Discussion

Teacher responses to the technology planning framework have revealed some valuable findings which can be used to inform future planning in LEOTC and technology. As argued by Falk and Balling (1982), site selection which offers a single focused learning experience is advantageous, and although the chocolate factory host gave greater than usual emphasis to the chocolate making phase of the visit, teachers reported that the concluding session which involved making lollipops proved to be a distraction for some of the students. On the other hand, the thorough preparedness of students for both the technology-focused factory visit and the design task ahead appropriately set the scene for ensuing learning opportunities. This requires teachers, students and parent-helpers to have a clear purpose for the visit and at least some understanding of the knowledge and skills necessary to achieve these goals.

Jarvis and Pell (2002) refer to the importance of teachers creating a 'need to know' amongst pupils – arming them with a genuine research purpose to their tasks during a site visit. The impact of prior knowledge on student learning has been studied by Falk and Adelman (2003) and the importance of initial visitor interest and the associated benefits to learning has been identified. By providing students with the opportunity to acquire relevant knowledge of chocolate making prior to the visit, and an understanding of the language of the process, students' ability to fully engage in the experience appeared to be maximised, and learning opportunities enhanced. In addition, by organising sufficient parent help during the visit to enable the role of the teacher to be one of overseer rather than supervisor permitted the teachers to record the visit, troubleshoot and observe the visit in greater detail. The teachers reported that this allowed for a finer-grained evaluation of the visit and the identification of elements that needed follow-up during post-visit activities. The photographic record collected as a result of this 'freeing up' of teacher responsibilities became an invaluable tool in reviewing and reflecting on the chocolate making process and evaluating student learning. These observations reflect the work of Anderson, Thomas and Ellenbogen (2003, p. 3) in which they argue that it is the teacher's responsibility "to help students see and connect with museum experiences with adequate pre-visit preparation and to creatively embed the experiences into the classroom curriculum following the visits".

The support of 'a more knowledgeable other' (Vygotsky, 1987) during the visit who is able to direct students' attention to the ingredients, equipment and the different shapes and structures possible when making chocolate also seemed incredibly valuable, as this, along with hands-on experiences during the visit, had the potential to inform the students' design decisions. Employing the help of parents to carry out this role, to interpret factory presentations and to model and encourage the use of language associated with the chocolate making process, also appeared to enhance students' understanding of, and

engagement, in the visit. Adequate preparation of parent helpers is obviously a key element as it is essential they acquire a shared understanding of the goals of both the LEOTC experience and the technology unit, as well as an appreciation of the students' final outcome, that is, a chocolate gift for Mothers' day.

Concluding remarks

The focus of this paper was to explore the perceptions of two teachers as they reflected on the effectiveness of the proposed planning framework incorporating LEOTC in technology education with junior primary students. In this study, technology education incorporated LEOTC to demonstrate expert practice to inform students' own design work and provided a clear focus for the visit. Designing the framework with teachers was a complex task that required a sound understanding of the technology curriculum, applying the elements of 'good practice' when using LEOTC as a teaching genre, and considering how to best manage the help provided by parents. An underlying assumption in the research was that both teachers were effective classroom practitioners and were experienced in working with five-year-old students. As the planning process unfolded, their understandings of technology education and LEOTC appeared sound but appreciating the finer detail of these and knowing how to bring the two together, whilst also considering the role of parents in the unit delivery, was where the framework offered its greatest support. The findings of this study have indicated the value of the co-designed planning framework in delivering effective teaching outcomes in technology education. Some evidence of learning outcomes has been gained through feedback from the two teachers regarding the long-term impacts on student learning. This aspect of the study will be reported on in a future paper.

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