Chocolates for Me or Chocolates for You? The Impact of a Learning Experience outside the Classroom on the Technological Practice of Two Five-year-old Students

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Abstract:

Knowledge of expert practice is a key element of Technology Education (Ministry of Education, 2007), and this paper which is part of a larger study, is a brief comparative study which investigates the impact a learning experience outside the classroom has on two students' technological practice. These students, Dana and Manahi, who are in their first year at school, visit a chocolate factory with their class to find out how to make a chocolate gift for Mothers' Day.

This study uses a qualitative case study methodology (Stake, 2006). Data was collected and analysed from three interviews, before, after and six months after the students' visit to the factory. The students' drawings and stories recorded after the visit were also analysed using themes emerging from the literature of Education Outside the Classroom (Anderson, 2003; Falk, 2004), Technology Education (Compton, 2009; de Vries, 2012; Jones, Buntting, & de Vries, 2013) and the characteristics of young students learning (Cohen, 2013; Siegler & Alibali, 2005).

The findings from this study identify a significant increase in both Dana and Manahi's context specific oral language, their understanding of the individual phases of technological development, and their ability to transfer these understandings to other contexts. Whilst these developments showed an encouraging improvement in their technological understandings, there existed a lack of continuity and connectedness (Moreland & Cowie, 2011) through the development of Manahi's chocolate gift. Compared with progress achieved by Dana, the gaps in Manahi's understandings impacted negatively on his perceptions of the purpose of the visit and the final goal of his practice.

Key words: technology education, primary, technological practice, Education Outside the Classroom, connectivity

Introduction

Technology Education in the New Zealand national curriculum aims to develop a broad technological literacy through students participating in learning programmes in which they engage in technological practice, and in so doing, develop technological knowledge to inform their practice, and gain an understanding of technology as a domain in its own right. Experiencing and exploring contemporary examples of technological practice is recognised as an effective way of developing technological literacy (Ministry of Education, 2007) and in this study, students visit Candyland, a chocolate and confectionery factory, to find out how to make a chocolate gift for Mothers' Day. The broader study, from which this paper is drawn, describes the development of an intervention model which aims to provide guidance for teachers of very young students when planning a technology unit that includes a visit outside the classroom. The intervention model is divided into three chronological phases, preparation before the visit, organisation during the visit and follow-up after the visit. Table 1 shows the domains and themes for analysis which are relevant to this paper.

Dana and Manahi are five-year-old students whose data are used in this paper. They attend different schools, one rural and one city school, and are two of the 16 New Entrant students participating in the broader research project. The findings of the study noted that both students embarked on this project with a good level of oral language, and a range of prior experiences which supported their engagement with the chocolate-making project. However, in looking across Manahi's data, it became obvious that a lack of continuity and connectivity (Moreland &

Cowie, 2011) had arisen between some stages of his product development. In comparison with Dana's experience, Manahi did not always recognise the links between the stages, perhaps seeing each one as an end-point in its own right rather than one step in a more extensive process. These disconnections prevented him from fully understanding the purpose of the visit, the links between the phases of the project and realising the final goal of the project.

Table 1 *Themes for Data Analysis*

Domain	Themes
Technology Education	Knowledge of the receiver of the gift
	The identified steps in a technological process Knowledge of materials and their properties
	The purpose of modelling
EOTC	The purpose of the visit to Candyland
Characteristics of 5-year-olds	The use of context specific language
	The ability to extend learning to new contexts

Key Ideas Which Inform the Research

A review of the literature which informs this paper is drawn from three fields of study, EOTC (Education Outside the Classroom), Technology Education, and Child Development specifically the characteristics of 5-year-olds. As outlined in the work of Falk and Balling (2001) the most valuable and memorable learning experiences outside the classroom are 'novel' experiences – those which are new, high interest experiences. Anderson (2003) argues that this type of memory is "overwhelmingly dominated and mediated by the socio-cultural identity of the individual at the time of the visit" (p. 405) and the lens through which the experience is viewed, strongly influences what is noticed and what is remembered. Building on these ideas, Falk and Adelman (2003) conclude that closely aligned with student interest in a visit, is their enjoyment of the experience. Anderson, Thomas and Ellenbogen (2003) agree but caution that these memories will be influenced by the age of the students, what is important to them and the emotional engagement they experienced at the time of the experience.

Research in the field of EOTC suggests that prior knowledge of exhibits at a site and a clear purpose for the visit, helps give focus to the experience and enables a student to engage more readily with the displays that s(he) encounters. Lambert and Balderstone (2000) argue for teachers creating a 'need to know' factor amongst students prior to going on a visit – effectively arming them with an authentic research purpose to be accomplished during the visit. It is well known, however, that these 'big ideas' can easily be lost on young students in-amongst the busyness of a junior classroom (Benson & Raat, 1995; Moreland & Cowie, 2011). Moreland and Cowie (2011) explore the challenge of maintaining a sense of continuity and connectedness through the project. Five-year-old students are known to view each phase of a technology project as an end-point in its own right, and do not always grasp the concept that each phase, each activity, is but one step in a more extensive process (Fleer, 2000; Rogers & Wallace, 2000). The links between the final outcome, the visit and the research tasks carried out prior to constructing the final outcome, are likely to be strengthened if the teacher and supporting adults draw students' attention to the connections between each of the technological activities.

Methodology and Methods

The research from which this paper is drawn employed a qualitative case study methodology (Stake, 2010) which included interviews with the two classes of five-year-old students before their visit to the chocolate factory, after the visit and again six months after. The students' drawings, stories and models were also analysed according to themes drawn from the literature and from the data (Braun & Clarke, 2006). In addition, evidence was sought which indicated how the visit to Candyland influenced the students' conceptual and procedural understandings of making chocolates, their design decisions, and whether a connection was made between the visit and the students' technological practice. The development of their understanding and use of context specific vocabulary was also of interest.

The students' visit to Candyland was to be a 'novel' experience. Data gathered prior to the visit revealed that this was the first time Dana and Manahi had visited the factory. Both students were very excited at the prospect of going to the factory. However, the enthusiasm and the learning potential gained from the visit was to be tempered by what the two five-year-old students were interested in and what they would notice during the visit (Anderson, 2003).

Figure 1 shows four of the activities which were planned as part of the intervention model, and which were intended to prepare students for their visit to Candyland. A key feature was to introduce students to the issue of their technology project i.e. how could they contribute to the celebration of Mothers' Day? The teachers steered their students in the direction of creating a chocolate gift, and Candyland was identified as a place to visit to find how the students could make their chocolates.

What do we already know about chocolate	Investigating and tasting chocolates.	Where does chocolate come from and how do you make it?	What do chocolate ingredients taste like?
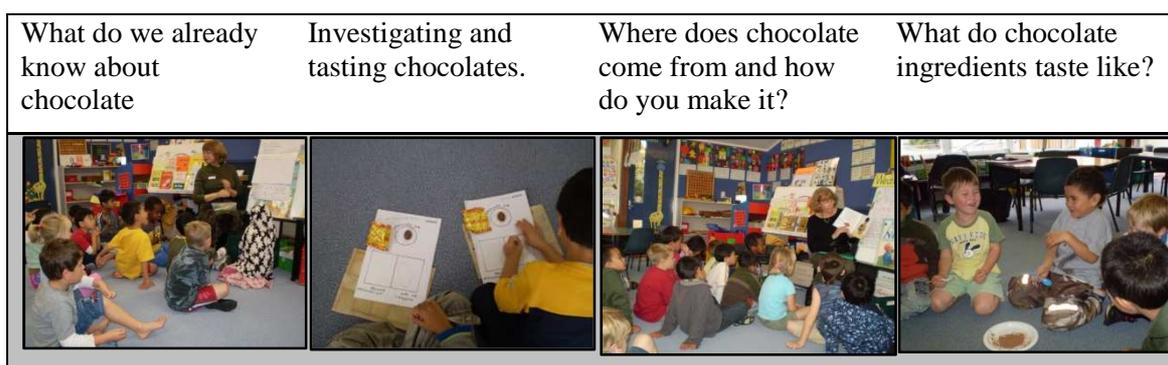
Figure 1. The pre-visit activities of the intervention model

The first document that was analysed was Dana and Manahi's drawings and scribed stories. Manahi's ideas are shown in Figure 2 and detail his existing knowledge of how chocolates are made. A brief analysis suggests that Manahi had a small number of conceptual and procedural understandings associated with making chocolates. His description indicates that he had had previous experience with baking, and knew that some chocolate products contain peanuts and sprinkles. He was familiar with the use of cream and had possibly seen it used when making other food-stuffs. He associated the sun with melting chocolate and he also appeared to associate heating and cooking ingredients with making a food product. His reference to rectangles suggests something of his previous experiences and how he conceptualises chocolate.

Dana also indicated in her drawing and story that she had had previous experience with baking and was able to list ingredients such as butter, flour, baking soda and 'brown stuff' to make chocolate. She was aware that some ingredients needed to be melted and thought the completed mixture should be put in the oven.

These ideas were consistent with a number of students who associated 'cooking' ingredients with making a food product, without differentiating between those that needed to be cooled in order to harden them and those that required heating.

Name: Manahi

I think chocolate is made like this:

"They make it with some cream and some peanuts and sprinkles. They put it into the sun and they cook it. Then they make some rectangles and you eat it."
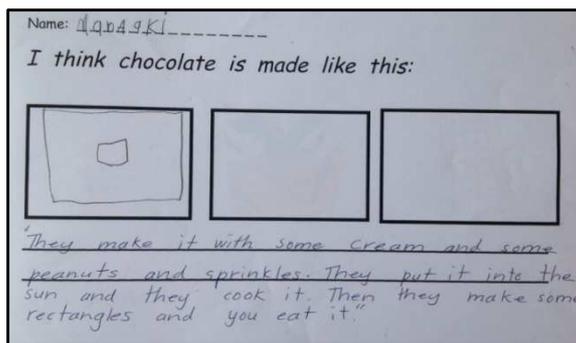
Figure 2. Manahi's first ideas about making chocolate

The first interview before the visit offered some key information about the student's prior knowledge of making chocolate and their understanding of the visit. Apart from one student, Manahi and the students from his class were generally unclear about the purpose of their visit to Candyland and appeared to have made no connection between the task of finding out how to make their chocolate gift and physically making it. In comparison, Dana, whose response was typical of the students in her class said, "'Cos to find out how to make chocolate". She followed this by saying the chocolate was to be "for Mummy". Looking across the data gathered prior to the visit, there is evidence to suggest that the intent of the visit may have been underplayed by Manahi's teacher, with attention given instead to ensuring the students were adequately prepared for engaging with the context of chocolate-making, being familiar with the vocabulary associated with chocolate-making and knowing something of the process required to make it. This resulted in an important link between these early stages of the project being missed by the students in Manahi's class.

The visits to the factory progressed smoothly and Dana, Manahi and their two classes explored the facility viewing the ingredients and equipment required to make chocolates, and the extensive array of shapes and colours of chocolate products which were on display. They gained further information about the process used in the factory to create chocolate products and this section of the visit concluded with an opportunity for the students to make a small chocolate fish to take home (see Figure 3).

Finding the moulds, colourings and fillings to make chocolate	Seeing a range of shapes and colours that can be used to make chocolate	Finding out how they make chocolates at the factory	Making a chocolate fish at the factory to take home

Figure 3. Student activities during the factory visit

A final part of the factory tour was an opportunity for the students to participate in a presentation in which the factory presenter showed them how to make a lollipop on a stick. This was very popular with the students but the drawings and stories collected directly after the visit confirmed that this activity distracted them from their focus of finding out how to make chocolates.

The research of Bruck and Ceci (1999) and latterly Cohen (2013) highlight the relative ease with which young children's memories can be altered. In a court of law for example, they tend to be susceptible to leading questions, suggestions and possibly by what they think a listener wants to hear. From this we can deduce that whilst children's memory can be manipulated by outside influences, the strategies used in these situations can be advantageous when applied to enhancing memory recall in the classroom. This concept became part of the intervention plan. In order to enhance students' recall of their visit, Dana, Manahi and their two classes were to draw a picture and write a story on their return to school. Whilst this was intended to focus on the chocolate-making presentation, the students in Manahi's class were given an open task in which they could draw "something they remembered from the visit". Seven of the eight students, including Manahi, wrote about the lollipops. Manahi described his picture to his teacher (see Figure 4). He said:

> I went to Candyland. I got to make a lollipop. The man put some candy mixture into a machine to roll it out. He put some stripes on it. I twisted my piece and turned it around and put a stick in it. Then I put it in a bag to take home.

This shifted his focus from the intent of the experience and became a lost opportunity for him and his classmates to consolidate their new knowledge and to maintain the continuity of their progress through the unit.

Figure 4. Manahi's drawing showing how he made a lollipop

The next phase of the technology unit stepped the students through a review and consolidation of the learning they had achieved during the visit to Candyland, a simple research component in which they presented a survey to their mothers to find out the type of chocolate that she preferred, and followed by the creation of models and drawings showing the chocolate they would make as their Mothers' Day gift.

Manahi duly took his survey home and reported in his second interview that his mum liked milk chocolate and brown chocolate but did not like dark chocolate. (I interpreted her preferred chocolate as being milk chocolate and white chocolate.) He also reported that his mother liked having peanut and caramel filling in her chocolate. Dana said, "We had a list (of chocolates) and my mum chose all of them. She qualified this by saying that her mum liked caramel best. In addition to responding to the preferences of their intended recipient, these tasks also had the effect of refocussing the students on the task of designing and making the chocolates for Mothers' Day.

Manahi's drawing and story of how he was going to make his chocolate gift showed that he had developed slightly more sophisticated context-specific language and a limited but accurate description of the steps he needed to take in order to create the gift. He explained to his teacher that he would need to, "Put the melting chocolate into a mould and put it into a big machine and

then wrap it up". This reflected the process he had observed at Candyland, with "the big machine" being a cooling tunnel into which all the students' chocolate fish were loaded for hardening. Dana's response was the same with the exception that she was able to name the 'cooling machine' that "made the fish go hard". Manahi's drawing, however, showed a significant broadening of his ideas and an awareness of the possibilities for colour and shape in his design. Manahi had drawn a picture of a pair of red chocolate sunglasses (see Figure 6). This differed from his initial reference to rectangular shaped chocolate and appeared to reflect the array of colours and shapes that he had seen at the Candyland shop.

Figure 5. Manahi's red chocolate sunglasses

The making day followed directly after this phase of research and design of their chocolate gift. A group of parent-helpers were organised to work with each of the two classes and to assist the students in making their chosen design. The parent-helpers from Dana's class were the same parents who had attended the visit to Candyland. The parents helping Manahi's class had not taken part in the visit although they had received information about the visit and had given their consent for their child to participate.

Another significant break in the continuity and connectivity of the process occurred at this point. It appeared that the intent of the visit, the students' research task, and how these were to connect with the making of the chocolate gifts were not well understood by the parents in Manahi's class, and two of the parents unexpectedly made a change to the students' task. The teacher of Manahi's class said, "I think a couple of mothers have said, "Right you're making one for mum and you can make one for yourself".

The opportunity for Manahi to make a chocolate for himself created another diversion which prevented him from experiencing and understanding the connections between the individual phases of his technological practice. Whilst the change was very appealing for him, it shifted his attention away from the original focus of creating the chocolate gift for his 'mum'.

It was also noted that amidst the enjoyment of making the chocolates, both the parent-helpers and the students in Manahi's class failed to take into account the survey information that students had collected and the designs they had chosen. Whilst changing design ideas is to be encouraged in technology, this oversight appeared to impact significantly on Manahi. During his second interview he admitted that after he had made his chocolates he had eaten them all. In response to my question he said, "Yes. I had both, I eated both of them. Yes 'cos I was tricking my mum".

Concluding Remarks

The full data set acquired through interviews with Dana and Manahi and the analysis of their drawings and stories indicate that over the course of the technology unit they had both gained topic-specific language, knowledge of ingredients, machinery and the equipment required when producing chocolate products. It was clear they had gained knowledge of the technological process and the steps required to create a product. Manahi's drawing of the red chocolate

sunglasses for his Mothers' Day gift suggested that he had benefitted from his visit to the factory and had been inspired by the colours and shapes of chocolates that he had seen there. Unlike Dana, Manahi had not, however, understood the purpose of going to Candyland. Whilst he acknowledged that he had learnt "to make the chocolate" during the visit, there was no sense that he connected this with his own practice. The diversion created by the parents in his class when the students made their chocolates was sufficient for him to lose sight of the intended final outcome, resulting in an after school feast for a small boy rather than the giving of a chocolate gift on Mother's Day.

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