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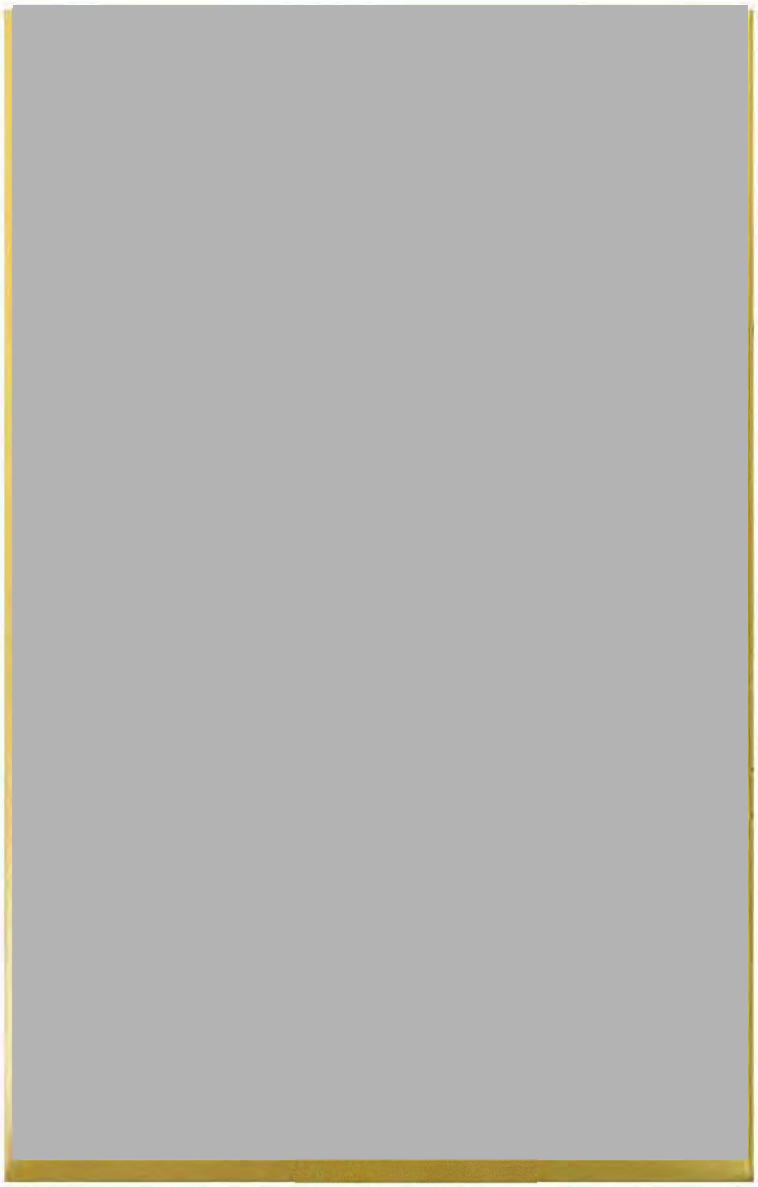
Mana Tohu Mātauranga o Aotearoa
New Zealand Qualifications Authority

# Scholarship Technology 2024

# TOP SCHOLAR

[redacted]

# Vegan m!lk chocolate bar for [redacted] Chocolate



[redacted]

[redacted]

# INTRODUCTION

My scholarship project was the design, prototyping, and production of a vegan m!lk chocolate bar.[1] I did this by following a careful research and development process, using food technologist practice to trial and solve problems. I worked closely with my key stakeholder [redacted] throughout the process, and all my decisions were informed by extensive identification of ingredients, research, sensory testing, and feedback from multiple stakeholders. This allowed me to create a product for market of the highest quality. My key stakeholder, [redacted], gave very positive feedback on my final product, saying that "the brief to [redacted] was to produce a vegan friendly m!lk chocolate inclusion bar that would have broad appeal, particularly at Christmas time. After some initial flavour research and development work, he landed on the concept of a hokey pokey inclusion bar. We were very supportive of this as it fits well with our brand and current flavour range – it's fun, nostalgic and a crowd favourite …the resulting bar is a delicious, rich hokey pokey m!lk chocolate bar that we know will sell well." It is currently undergoing shelf-life testing with the intention of a 2025 Christmas release by [redacted].

I was keen to develop a vegan product as I have been interested in sustainability for a long time. I found my love of food in 2020 and have since spent a lot of time working with food, including cheffing in restaurants. I have spent more than two years volunteering at a food rescue restaurant, [redacted], which operates with the goal of reducing food waste, a massive problem globally. Last year I created a recipe for a vegan ice cream that [redacted] could use as part of a food technology project. I am not currently vegan, but I have always been interested in a plant-based diet, in particular the element of sustainability.

When I began this project, I had not yet decided on working with [redacted], but as I discovered that they had an opportunity that fit the scope for a scholarship project, and aligned with my values and interests, I leapt at the opportunity.

At the beginning of the process, I had no idea of where I would end up or what I would produce. Working with my key stakeholder and other experts was a really rewarding experience and I enjoyed working through the process step-by-step to produce a viable, feasible product that I am really proud of.

The key steps I followed were:

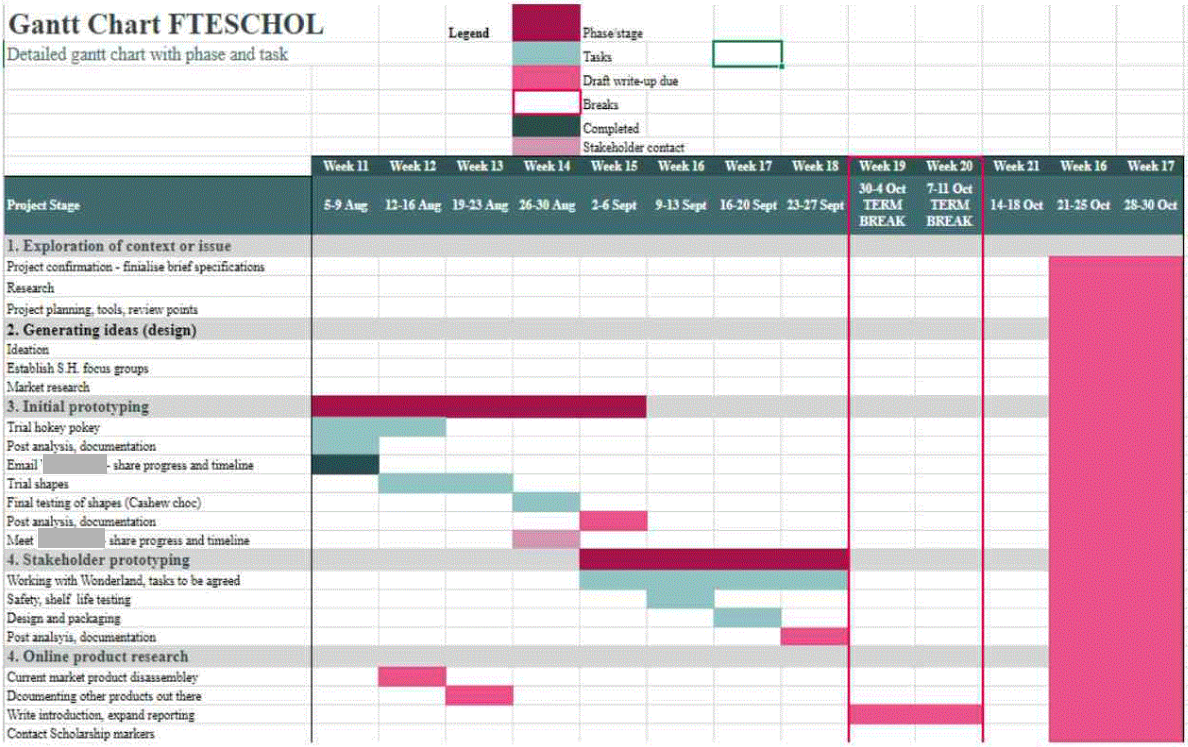
- initial research and exploration where I met with a variety of stakeholders and experts to choose my topic;
- ideation through a research process to generate three ideas to test;
- conceptual design where I investigated the three different ideas, concluding that hokey pokey was the most suitable for taking forward to the next stage;
- prototyping where I developed my hokey pokey recipe and method for incorporating into the chocolate through rigorous testing;
- designing packaging for my key stakeholder and final production preparation to ensure my product would be safe and fit-for-purpose; and
- production of 23 bars from cacao beans to final packaged products for my key stakeholder to shelf-life test for release in Christmas 2025.

[1] Censoring the vowel in some vegan alternatives is a popular trend amongst vegans.

## Project management

Development of a vegan chocolate bar together with my key stakeholder was a large project, so I made sure to properly make use of my time. I created an outline of my project, highlighting key tasks, and later, when it became more important to manage my time, I put my tasks into a GANTT chart to help myself keep on track. I had weekly meetings with my food technology teacher where we discussed my project, which helped me keep on track. I had multiple deadlines for myself when things needed to be done.

**Figure: Gantt chart used for time management**




## About this report

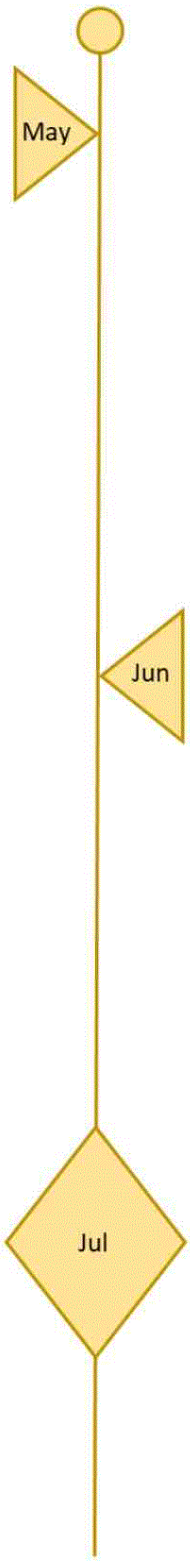
The first section of this report is a summary of the food development process I followed, from start to end. The rest of the report provides more detailed information. Each section starts with the relevant section from the summary and then fully explains the process I followed. I have included examples of the pictures I took, and graphs and research notes I made to document my process and capture findings. I wasn't able to include all my records due to space considerations. At the end of each section, I fully explain the decisions and outcomes made at each stage.

The sections in the report are:

- visual summary of my food development process;
- initial research and exploration;
- ideation;
- conceptual design;
- prototyping;
- going into production;
- summary of final product; and
- evaluation.

# OVERVIEW OF PRODUCT DEVELOPMENT PROCESS (1/2)

[redacted] bar for [redacted]



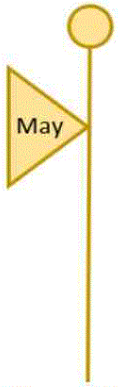

| STAGE | MAIN TASKS | KEY OUTCOMES |
|---|---|---|
| **INITIAL RESEARCH & EXPLORATION**<br>Explored a wide range of options to find a feasible product that interests me and aligns with my values | Created **recipes** and **produced trial products**<br>Conducted **sensory testing** on trial products<br>Presented results of sensory testing with my key stakeholder Wonderland and compared with their previous research, **identified key stakeholder preferences** | ▷ Work with [redacted] and develop a nostalgic, vegan chocolate product<br>**Rationale**: best fit to my interests and ethics, good opportunity to fully develop a product (from beginning to end) that will go to market |
| **IDEATION**<br>Generated ideas to test for [redacted] by seeing what else is available and what consumers prefer.<br>Learnt about chocolate making so I understood the process and requirements. | **Deeper research** into vegan market and nostalgic flavours<br>**Consumer survey** about flavour preferences<br>Research on other current products<br>**Brainstorming ideas**<br>**Current market product sensory testing** and **disassembly**<br>**Initial chocolate making** research, and the process of making a small batch by hand | ▷ Pursue 3 options for nostalgic and New Zealand flavoured chocolate – hokey pokey crunch, kawakawa and horopito, Turkish delight<br>**Rationale**: the options align with [redacted] product line and specifications; 3 options ensures I have sufficient options to test and trial during prototyping |
| **CONCEPTUAL DESIGN**<br>Investigated the 3 options from the ideation stage to see which is suitable for prototyping | Created **recipes** and **produced trial products**<br>Conducted **sensory testing** on trial products<br>Presented results of sensory testing with my key stakeholder [redacted] and compared with their previous research, **identified key stakeholder preferences** | ▷ Take the hokey pokey crunch idea forward to prototyping, other 2 ideas to be discarded<br>**Rationale**: positive sensory testing and key stakeholder feedback for hokey pokey<br>▷ Prototyping and further development needed to make the hokey pokey feasible<br>**Rationale**: my trial hokey pokey had weaknesses; new specifications agreed with key stakeholder |

# OVERVIEW OF PRODUCT DEVELOPMENT PROCESS (2/2)

[redacted] bar for [redacted] Chocolate

| | STAGE | MAIN TASKS | KEY OUTCOMES |
|---|---|---|---|
| Aug | **PROTOTYPING**<br>A – developed suitable hokey pokey – safe, ethical, vegan, to meet **key stakeholder specifications**<br>B – trialed methods for incorporating hokey pokey into chocolate bar to meet **key stakeholder specifications** | **Research into the science** of hokey pokey<br>**HACCP Plan** created<br>Created **base hokey pokey recipe, 15+ trials** to find the best method<br>Findings captured and compared using a **standard template** to follow proper technologist practice<br>**4 incorporation methods created** and **sensory tested, stakeholder feedback** used to improve each of the methods – adjusting chunk size and depth in chocolate<br>**Multiple trials** to learn how to temper chocolate | ▷ Hokey pokey recipe finalised – sweetened with golden syrup<br>**Rationale**: best sensory testing feedback, stable product<br>▷ Hokey pokey to be incorporated into chocolate in 5g chunks and 2mm dust<br>**Rationale**: incorporation method met key stakeholder specifications – produced a good hokey flavour in the chocolate and retained crunch |
| Sep | **FINAL PRODUCTION PREPARATION**<br>Ensured product could be taken to market – marketable and safe | Development of **packaging**, including **branding** and **nutritional analysis**<br>**Check in with secondary stakeholder** – positive feedback<br>**Process plan** to meet health and safety requirements<br>**Shelf-life testing** | ▷ Health and safety plans requirements fully met<br>▷ Final name and packaging approved by key stakeholder and secondary stakeholder |
| Oct | **FINAL PRODUCTION**<br>Made final chocolate bars to production standard as proof-of-concept | Made **base chocolate** – vegan cashew milk chocolate using professional equipment; end-to-end process: from taste testing and selection of raw beans. Managed all production of chocolate (1.7 kgs) myself, following [redacted] process<br>**Final product disassembly**<br>Made final bars – **final hokey pokey** to specification determined in prototyping, **incorporation into bars** as agreed with key stakeholder<br>**Shelf-life testing** for going to market in 2025 | ▷ Final product successfully produced, bean to bar<br>▷ Shelf-life testing underway<br>[redacted] |

# INITIAL RESEARCH & EXPLORATION




**PURPOSE**

Explored a wide range of options to find a feasible product that interests me and aligns with my values.

**MAIN TASKS**

**Initial research**: veganism; consumer survey; Wonderland Chocolate and their process

Met **potential stakeholders**, talked to experts

First meetings with **key stakeholder**, developed initial specifications

**KEY OUTCOME**

▷ Work with [redacted] Chocolate and develop a nostalgic, vegan chocolate product

**Rationale**: best fit to my interests and ethics, good opportunity to fully develop a product (from beginning to end) that will go to market

## What I learnt from my initial research

Veganism is a growing trend, both in New Zealand and globally. It is a fairly recent emergence commercially, and as such there are many gaps in the market. As trends emerge favouring ethical production and sustainability, and new methods of food production are developed, veganism will naturally expand into new product areas. Vegan milk chocolate products have had a rise in popularity in recent years, many small chocolate producers have created vegan options, and in 2022, the large NZ chocolate making company, [redacted] made an oat milk chocolate.

For many people prioritising a plant-based diet, vegan alternatives are important. Though all dark chocolate is naturally vegan, many people feel that dark chocolate does not provide the same experience, it is an intensely rich product, as opposed to the creamy lightness that milk provides in chocolate. The founder of the vegan chocolate company I am working with wanted to create "something moreish", that would make a pleasant snacking food. The founder saw that there were no other quality vegan milk chocolate products on the market and wanted to fill the gap. [redacted] is owned and run by [redacted], who has always had an interest in food, and has spent 20 years in marketing (half of those in food). When [redacted] became vegan in 2020, she instantly started craving milk chocolate. However, she felt there were no products on the market that tasted as good as non-vegan equivalents.

Vegan chocolate on the market is typically either oat or coconut based. Oat was the base of [redacted] first plant-based chocolate, and it fell flat, with extremely poor reception. [redacted] oat milk chocolate has since been pulled from supermarkets. Oat, being a cereal, is inherently grainy, and provides a waxy finish to the chocolate. Coconut alternatives to vegan products often have a mixed reception due to the strong flavour that coconut adds. Though there are some vegan alternatives to milk chocolate on the market, they are still relatively new, and the number of products is limited.

## Research into [redacted] Chocolate

[redacted] chocolate is cashew based (rather than oat or coconut), and has no strange taste, nor a difference in texture. It is a unique product developed by [redacted] Chocolate, and the concept is [redacted] IP, something she came up with. This cashew chocolate has won Wonderland multiple awards. [redacted] is now in a number of notable shops, such as [redacted].

Wonderland prides itself on using only the best quality ingredients. All their cacao is single origin. Their sugar is organic cane sugar, and their chocolate only contains natural ingredients, with no additives. This means that their chocolate is the best it can be for you and is vegan and gluten-free. Using organic cane sugar allows a person to consume a lesser amount of ultra-processed foods, which is a priority for many people today.
Wonderland's cacao is ethically sourced. This is a high priority for [redacted].
[redacted] **Chocolate is all sourced from one supplier,** [redacted] ([redacted] is the creator of the term Transparent Trade, which they define as "radical transparency as a means to an end, … an approach to enabling … producer profitability for the ultimate goal of a more equitable and accountable way of trading cacao."([redacted] 2024) [redacted] **aims to decommoditise cacao, instead prioritising ethical, sustainable, and traditional methods of farming that allow flavour and aroma to be put first.** [redacted]s a certified B Corp, which means they have been independently verified to "meet high standards of social and environmental performance, accountability, and transparency." (B Corporation, 2024) They are the only cacao supply to publish fully verifiable data regarding their supply chain, a standard only they have met for more than ten years. [redacted] believes that by telling the story of the cacao, chocolate makers are able to both demonstrate the ethical nature of their product and have a better connection with their cacao, thereby increasing the chocolate quality and ensuring its sustainability. Cacao is a market that is in constant flux. This is true more so now than ever due to climate change. [redacted] solution is to bring their price points to a level where fluctuations in the market will not affect them, allowing a steady income for their producers. Uncommon Cacao also prioritises employing women.

[redacted] **currently sells a range of chocolate bars and three different non-bar chocolate products** (Caramels, salted caramels, pineapple lumps). All of [redacted] products are packaged in playful packaging, and the flavours aim to be nostalgic flavours. This is because when [redacted] was researching the market prior to launching [redacted] she found that the gap on the market was on a very emotional level. [redacted] surveyed people on their opinion of multiple products and people wanted something indulgent and fun rather than a product fortified with B12 (a vitamin vegans are typically deficient in). All [redacted] packaging strongly reflects this concept. All of [redacted] chocolates are made with cashew m!lk, and all but one-use Dominican Republic cacao. The bar that does not currently use the same cacao is titled [redacted] and is a quarterly bar, meaning that the flavour rotates regularly.

**Picture: a product from [redacted] range**

## About my stakeholders and experts

The beginning of my project was a period of initial research and exploration. I had multiple meetings with potential stakeholders and experts, and I had the freedom to go wherever interested me. The priority in this first phase of my project was therefore to identify a particular stakeholder and product that would be the foundation of my scholarship project.

### Meeting potential stakeholders

Before deciding to work with [redacted] I met with a range of other potential stakeholders.

[redacted] is the head of the international department at my school, [redacted] and she regularly works with food technology students. I met with [redacted] on 21 May. She often goes to 'fairs' overseas where she is competing with more than 60 other schools from around the world, which potential students can choose from. [redacted] has to stand out. As such she will often take New Zealand products with her, which are sometimes products made by food technology students. Although I am not working with her directly, she is a valuable stakeholder as she values products with a strong story such as mine.

I met with [redacted] general manager at [redacted] on 21 May. [redacted] has recently taken over the canteen at [redacted] and she has given the [redacted] food technology students the opportunity to develop a product that the canteen could sell. Though [redacted] values align with my own, I am not interested in working with the canteen. It was good to explore this as an option, but the type of food that is made and sold at the canteen is simply not what inspires me. I already have experience in this type of food production from previous employment.

I met with [redacted] head chef and owner of the [redacted] on 27 May. [redacted] became an expert who provided me with advice as part of my product development rather than a stakeholder. [redacted] is currently working on expanding the vegan options at her cafe, and she did a demonstration where she cooked an eggplant curry. Her goal is to create dishes that are good stand alone, not just good as vegan dishes. [redacted] sees visual appeal to be extremely important. Meeting with [redacted] proved to be extremely valuable, as it later gave me insight into what I should be focusing on when I created my product.

I finally met with [redacted] on 10 June. I had already had one phone call with her on the sixth of June, and I felt that she would be an ideal primary stakeholder. I felt this because she had a significant opportunity for me - a product that could go to market. When I got to talk with [redacted] about what her brand meant to her, I realised how much her values aligned with mine. I have always found the scientific side of food technology to be very interesting (especially chemistry). Therefore, the opportunity to make a confectionery, which is something quite technical and based in science, interests me quite a lot. It is for these reasons that I decided to choose [redacted] as my primary stakeholder.

When I first met with [redacted] she presented me with [redacted] her rotating chocolate bar that can vary and size production runs. This meant that [redacted] was a perfect opportunity for me to create a product, where [redacted] would be happy to work with me as a stakeholder and take a product I created to market if it met her production, marketing and quality values.

In my meetings with [redacted] when we agreed to work together, we first agreed on the scope of the project, working out what would work best for both of us. We agreed that working up to shelf-life testing would be best for my project and her. We agreed on this as shelf-life testing will take a minimum of a year.

## The experts and stakeholders I worked with throughout my project

These were my principal stakeholders and experts - there were a number of others who I identified during my product development process. I worked closely with my stakeholders and experts in tandem with a wider panel of technology teachers, many of whom had design experience or were part of [redacted] Chocolate's target market. The feedback and expertise of these groups was vital to my project. Their different perspectives and skill sets allowed me to get the most out of my project and develop a well-rounded product.

My key stakeholder was [redacted]

[redacted]ntroduced above, was an important secondary stakeholder that I maintained a relationship with throughout the project.

[redacted]s a chef and fellow food technology student. He has years of expertise working with food which makes him a valuable resource, especially with technique and process changes that I had to make in my project.

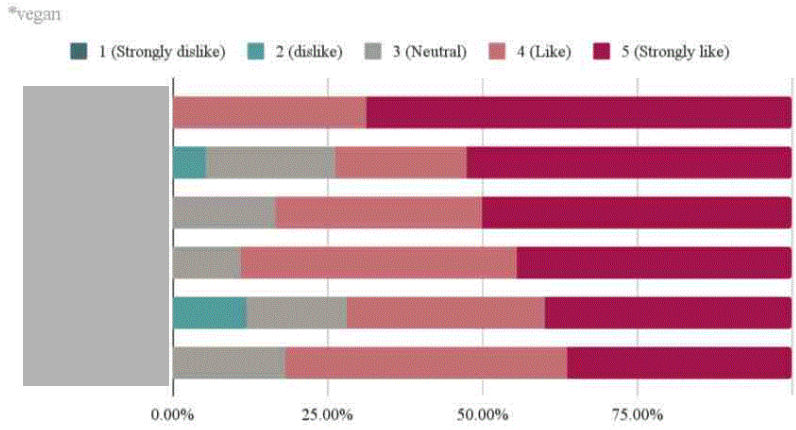
[redacted]s a second-year food technology student at [redacted]and is the head of outreach at [redacted]. [redacted]has experience with food technology, and once went through the same course that I am going through at [redacted] I met with him to talk about my project, he was able to give me advice, including about a project of his own that he had completed at [redacted] This project was valuable, as it allowed me to follow proper technologist's practice.

The teachers in the food department, [redacted] all have extensive experience with food - including in a cheffing, scientific, and teaching capacity. The technology teachers acted as valuable stakeholders who helped guide my project.

## Learning about the market as a whole

At the same time as I was deciding which stakeholder to work with, I had the opportunity to survey a large group, at a school open day on 10 June 2024. The survey asked respondents to try a selection of chocolates, and rate them on a 1-5 scale. This allowed me to understand better what consumers are interested in. '[redacted] chocolate was the most popular flavour, and dark chocolate tended to be more popular than milk chocolate. One interesting finding was that the macadamia and the raspberry chocolates, which were not vegan, were some of the least popular chocolates. Of the vegan chocolates, [redacted]cashew milk chocolate was the least popular.

**Figure: survey results from open evening sensory testing**




This told me that many people prefer dark chocolate to milk chocolate. This was of particular interest to me because [redacted]chocolate has a brand preference for making milk chocolate rather than dark chocolate. Additionally, [redacted]Milk Chocolate was the least popular variety.

Despite this, I was still interested in working with [redacted]Chocolate. This is because many of the people who came through [redacted]on the open evening may not have been my target market, and my sample group was relatively small. [redacted] Chocolate has found a significant group of people who are interested in vegan milk chocolate. In addition, the poor reaction to [redacted]Chocolate may be partly a result of neophobia (people will naturally dislike a food unfamiliar to them).

The [redacted] raspberry slices chocolate, which I thought would do poorly as I did not personally enjoy it, was received quite well. This shows me that people are quite interested in fun flavours. I made sure to ask that only those over 16 completed my survey because 16 is the age of consent, and any evidence obtained from under 16's is unethical. I made sure everyone was informed of all possible allergens.

## Learning more about [redacted] process

It was important for me to follow proper technologists practice as part of my scholarship project. This is because I was trying to create a product that could go to market, so all the correct steps should be taken in my project. When I met with [redacted] she talked about her process in detail, and how she launched her company.

[redacted] started her process by focus group testing three ideas, using both friends and people she didn't know, as friends may give biased answers. Once she had settled on a product which she determined was viable, she then did disassembly's of similar products. This involved reverse engineering other vegan milk chocolates on the market. [redacted] found that many of the products produced poor results (e.g. a coconutty flavour) or only worked through the addition of additives, something she was against. She then brainstormed different ways she could make vegan chocolate creamy. After a long period of product testing settled on cashew milk as a way to make vegan milk chocolate.

[redacted] prototyped this process to create a good, unique product. I will be using these practices (such as disassembly's, reverse engineering) in my ideation phase.

**INITIAL RESEARCH AND EXPLORATION, KEY OUTCOMES (10 June)**

- I decided to work with [redacted] Chocolate as my primary stakeholder. Working with [redacted] I was able to create initial specifications for my product. My initial specifications agreed with [redacted] were:
  - Chocolate bar must be vegan;
  - Chocolate bar must work as a [redacted] release;
  - Chocolate bar must be visually appealing;
  - Chocolate bar must be safe to consume; and
  - Chocolate bar should utilise fun, nostalgic flavours.
- As my project progressed, these specifications changed to fit the brief as a result of how my chocolate bar evolved due to the technological modelling that took place, revealing my bar's unique requirements.
- The outcome of this phase was that I decided that my project was to design a vegan product. Working with [redacted] I would have the opportunity to prototype my product and do a batch test run. I would be able to make my own base chocolate, with the aim of creating a fun product, ideally utilising nostalgic flavours. I would also aim to make a product that was gluten free. Being gluten free was not one of my specifications, as [redacted] has created non-gluten free products in the past. However, she prefers not to. The product should be aimed towards a vegan market.

# IDEATION

Jun

| PURPOSE | MAIN TASKS | KEY OUTCOME |
|---|---|---|
| Generated ideas to test for Wonderland by seeing what else is available and what consumers prefer.<br>Learnt about chocolate making so I understood the process and requirements. | **Deeper research** into vegan market and nostalgic flavours<br>**Consumer survey** about flavour preferences<br>Research on other current products<br>**Brainstorming ideas**<br>**Current market product sensory testing** and **disassembly**<br>**Initial chocolate making** research, and the process of making a small batch by hand | ▷ Pursue 3 options for nostalgic and New Zealand flavoured chocolate – hokey pokey crunch, kawakawa and horopito, Turkish delight<br>**Rationale**: the options align with Wonderland's product line and specifications; 3 options ensures I have sufficient options to test and trial during prototyping |

The next phase in my project was the ideation phase. This stage was before the conceptual design phase, where I needed to research what sort of flavours I should be utilising, what products are already on the market, and the market as a whole. I also did a lot of research into how to make chocolate, different types of chocolate beans, and I made my own chocolate so I would fully understand the process.

## Research

### The vegan market - international and national (17 June)

To make the most of my project, I needed to research the opportunity presented to me, which was to create a vegan product in a market-based context. The vegan market is a relatively new market in Australia and New Zealand, it presents an excellent opportunity for businesses.

With relatively few vegan products on the market, and a growing population, there is a great opportunity to be capitalised on by the food industry. Vegan food is a rapidly growing industry worldwide, both amongst vegans, and those simply eating less or no meat, of which 34% of New Zealanders are. A report by the Vegan Society in 2022, which has data from 600 Australians, and 400 New Zealanders, found that the majority of those surveyed identified as flexitarian (following a largely vegetarian diet). The report found that more than 40% of respondents purchase vegan food/drinks at the supermarket "often" or "every time", and 35% of respondents always purchase vegan food/drink at restaurants. More than 50% of respondents would like to see more vegan products in supermarkets and restaurants. It was also found that 95% of respondents felt it was "very", or "somewhat" important for products to have third-party verification of their status as vegan. It is important for brands to keep up with these trends - this is true for all market trends, but especially so for those products which are plant-based. This is due to the intrinsic tie that plant-based diets have with sustainability.

Consumer demand for sustainable products is growing rapidly worldwide, and industries are rushing to keep up with this ever-growing demand. This is both a challenge to businesses, and an opportunity for growth and expansion, opening up the space for more jobs.

Sustainability is a key driver for trust in businesses, especially among younger consumers. Younger generations are soon going to hold the majority of purchasing power. Trust is essential for a good business; it is known to drive business by up to 400%.
Young generations (Gen Z, millennials) are “15% more likely than older generations to spend more money [on a trusted] brand.” Sustainability is tied strongly to the food industry, as it impacts both our environment and the long-term viability of the food industry as we know it. Reducing the environmental footprint of the food industry has presented significant challenges that have slowed implementation, so that we are now at a point where offsetting ecological impact has become a quite urgent issue. This is something that consumers have realised, that it is now at the forefront of their demands. Because of this, many food trends are emerging in relation to sustainability. Increasingly, businesses are moving towards sustainable packaging, one of the most visible aspects to consumers interested in sustainability. Besides sustainable packaging, other emerging food trends are food waste mitigation, a topic I have been interested in in the past, and plant-based solutions. Plant-based solutions have been rapidly growing in popularity due to the understanding by consumers of the effects that farming, especially of livestock, have on the environment. (Foti, L. 2024)

## Nostalgic flavours for New Zealanders: Kiwiana and Kai Māori (18 June)

“The quirky things that contribute to a sense of nationhood are called ‘Kiwiana.’” (“Nation and government - Nationhood and identity”, 2016) Kiwiana items are often kitsch, quintessentially New Zealand things. Some common Kiwiana flavours are:

- Pineapple lumps, which [redacted] sells a vegan version of;
- Pavlova, a meringue based dessert;
- Hokey pokey, an air-filled caramel candy that is popular in ice cream and chocolate; and
- Jaffas, an orange chocolate flavoured candy - [redacted] sells an orange flavoured bar.

These flavours, that many New Zealanders grew up with, are what I chose to focus on as part of my project development. I made the decision to do this because the [redacted] Chocolate brand is directed at retro, New Zealand flavours, especially those which evoke nostalgic feelings.
I also made a decision to investigate other more indigenous flavours of New Zealand, particularly kai Māori (Māori foods). Kai Māori is growing in popularity, and it is important to have an understanding of these foods, and the proper practices associated with them. In modern society, the familiarity that many New Zealanders have with kai Māori has diminished, and for most, is now limited to hangi, boil up, kai moana, and rewana bread. Today, earthiness is one of the defining flavours of kai Māori (earthiness is also one of the key notes in chocolate, making anything earthy a good pairing), and there are a number of plants that are closely associated with Māori food. Examples of earthy flavourings in Māori food are among others, kawakawa, horopito. As kai Māori is part of a culture that is not my own, it was important for me to understand and follow tikanga Māori, such as never harvesting kawakawa after it has rained. By exploring kai Māori, not only can I make use of a current market trend, but I can respect and honour the culture of the land that I am on, Aotearoa.

## Non-vegan chocolate products on the market (19 June)

is well known nationwide as a quintessentially New Zealand brand that is popular and based on quality ingredients. not only produces many retro-flavoured bars but originated many of New Zealand's retro-chocolate flavours. For this reason, I began investigating classic bars. Some of notable bars are:

- Honey, nougat, and almond - has tried to make nougat for her chocolates, but has been unsuccessful so far, as making a shelf-stable vegan meringue base has proved to be difficult;
- a gianduja based chocolate, this has the same flavour base as popular products such as Nutella;
- - this would not be technologically feasible the way currently makes her chocolates, which I got to see when I visited the factory on 10 June. This product works because of large, thick moulds, whereas bars are significantly smaller;
- -this again would not be technically feasible (for the same reasons as above, but is in the vein of products I would be interested in.
- . This bar is take on a with a honeycomb filling. This again was the type of product I considered I would be interested in.

## Vegan milk chocolate products on the market (19 June)

As veganism is a very modern trend, product availability is still quite limited. A lot of chocolate is vegan, but vegan milk chocolate is a very new product. Chocolate is one of the only producers on the market. another small batch chocolate company in Wellington, has two vegan milk chocolates, but they are very different from products. They sell an oat, and a coconut-based chocolate, and unlike there are no other flavours incorporated into the chocolate. When I tasted both of products, neither tasted very similar to milk chocolate. The oat was grainy. The coconut was overly soft and had noticeably different flavours to a normal milk chocolate. Because vegan milk chocolate appears to be almost non-existent outside of range, there is not much to be learnt from other products on the market, except that cashew is the best option for the manufacture of vegan milk chocolate.

## vegan products (21 June)

I learned a lot by examining own product line. It was necessary so I knew what flavours they have and did not repeat anything of current line. It also meant I was able to better understand as a brand. A greater familiarity with Wonderland gave me guidance, and it allowed me to create a product that was consistent with their overall product line.

has had three iterations of the ' bar. It first came out as a crunchy (which was first and only chocolate containing gluten) flavour, then a white chocolate (currently the only white chocolate has sold) with raspberry and lemon, and a (cinnamon, chilli). The crunch was made with a different cacao bean than all other products. The bar appears to have been used for quite exploratory flavours, and it appeared to me that potentially has decided to use the bar as an opportunity to test the

market. It gives her a chance to do a limited run that she could later make a permanent addition to her product line if the product performed well.

[redacted] other flavours are:

- [redacted]
- [redacted]
- [redacted]e
- [redacted]
- [redacted]

[redacted] products are quite different when compared to many artisan chocolates on the market. One of the biggest trends today is dark chocolate, often without flavourings. [redacted] has instead chosen to base its brand and products around flavoured chocolates. Dark chocolate flavour pairings typically end up being more intense, whereas [redacted] chocolates are all quite light, fun flavours. By examining [redacted] product line, I gained a better understanding of what flavour profile I should be looking to create in my conceptual design phase. I was previously focused on the concept of a nostalgic flavour, but examination of [redacted] line indicated that non-nostalgic, fun flavours are also desirable. Some products on [redacted] line utilise nostalgic flavours e.g. [redacted] or orange (which is the flavour of [redacted]), but many are simply fun flavours.

## Learning to make chocolate (24 June)

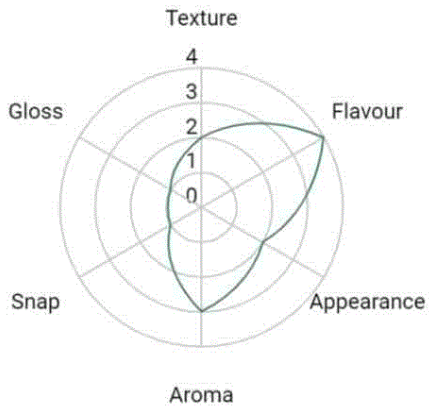
**Picture: cacao - chocolate by hand**

Before launching into the conceptual design phase of my project, I decided to do some initial research. As I decided to work with [redacted] and I had the opportunity to make my own base chocolate, I thought it important to teach myself about making chocolate. Going into my project, I knew very little about the making of chocolate. When I visited [redacted] Chocolate's factory, I saw multiple specialist machines in operation. I began my research simply by reading up on the process of making chocolate. I struggled to understand what people were talking about, so I decided the best course of action would be to attempt to manufacture a batch of chocolate at school.

To make my chocolate, I discussed the process first with [redacted] and researched intensively on the internet.

I began with 100g of cacao beans of unknown variety and origin sourced from a local refillery. After extracting the husks, I was left with 64g of nibs. I ground this using a mortar and pestle and an electric spice grinder with 26g of sugar to create a 64% dark chocolate. I then set this in moulds. The result was a nice flavour, though different to normal chocolate with notable acidic notes, and the chocolate was quite gritty. Peers, experts, and stakeholders who tried my product all agreed on this. My stakeholder group, the technology teachers at [redacted] liked the aroma. The grittiness is a result of not having the proper machinery. With modern machinery, chocolate is refined for tens of hours, and is ground superfine - the particle size is typically 25-35 µm. This was not possible to do by hand with limited time.

**Figure: sensory evaluation of dark chocolate, feedback from stakeholder group, Technology Teachers**



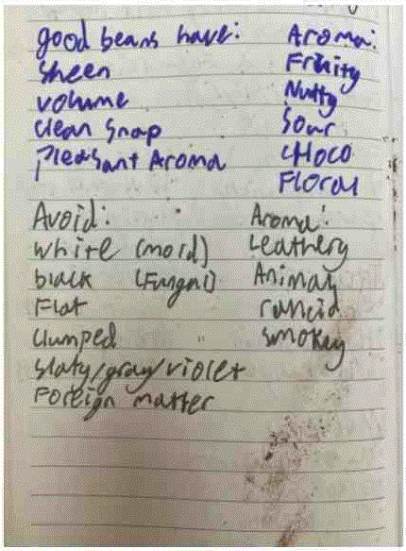

## The process of making chocolate (bean to bar) (25 June)

After I had made my own chocolate at school, I researched the process of making chocolate. I did this because I knew that eventually I would be getting to make chocolate at [redacted] Factory, and it would be important to understand

All of [redacted] chocolates are bean to bar, meaning [redacted] processes from beans, instead of working with cocoa mass, which many chocolate makers consider an inferior product, used only by large manufacturers.

Though the techniques I used to make my chocolate were quite primitive, I still spent time researching the process of making chocolate using proper equipment. I did this because I knew I would later have the opportunity to make my own base chocolate, so having a greater understanding of chocolate would allow me to do that better.

**Picture: notes on desirable traits in cacao**




### Choosing the right cacao beans

Cacao beans are similar to coffee in that different origins, different soil, different roasts can all have significant impacts on the flavour of the end product, and there is potential for complexity when treated correctly. When choosing the right beans, it is important to taste, smell, and look at the consistency of the beans. The primary flavours observed should be a pleasant bitterness with the correct acidity level. Pleasant undertones such as fruity, spicy, nutty should also be present. Smokey notes should be avoided. There are three key types of cacao beans.

- Forastero is the dominant variety on the market, it has an earthy, simple flavour
- Criollo makes up approximately 5% of the world's crop

    - It has a unique, complex flavour, a little bitterness present and the flavour is typically fruit forward, an aromatic
    - It has a super fine texture
- Trinitario makes up less than 10% of the world's crop
    - It is a hybrid strain that can result in a wide range of flavours.

There are many other minor hybrid strains. Later on, when getting to make my own chocolate, Forastero was the type of cacao that I chose following my selection process.

## Sorting, roasting cacao beans

The sorting, and roasting stages are the only stages in which major contaminants can be removed from cacao beans. When cacao pods are harvested, they are fermented for a number of days. This is usually done in heaps on the ground. This environment is known to expose the beans to multiple pathogens (typically E. coli and salmonella) together with other contaminants. Cacao moths, a certain type of moth that lives on cacao beans and mould, can also contaminate beans. Because of this, cacao beans are sorted to remove any visibly mouldy or otherwise undesirable beans. Before beans are roasted, any that are misshapen, cracked, cut, too small, or without a husk must be removed, as they will not roast at the same rate as other beans, and could contribute a burnt flavour.

Roasting plays the important step of controlling any biological hazards, essentially pasteurising the beans, and it is important to spend time with a roaster ensuring that the beans are always reaching 100°C. Aside from the control of potential hazards, roasting plays an extremely important role in the flavour of the chocolate, and the processes that occur later on. Roasting takes the beans from an acidic, vinegary flavour profile to a complex chocolate flavour that we are familiar with. Roasting removes some water and beans are already quite dry at approximately 7.5% water. However, the less water the better for a successful chocolate. Water can seize and ruin a batch of chocolate. Light roasting is the best way to bring out the flavours of the beans, as the darker the roast, the more amino acids and natural sugars are destroyed. Dark roasts are typical of mass-produced chocolate that is going for a very consistent chocolatey flavour profile, but complexity is lost when this occurs. When roasting beans, it is important not to roast them too much, as cooking will continue following the completion of the roast due to residual heat. Beans are then cooled (ideally overnight).

## Cracking and winnowing

Cracking and winnowing is the process of extracting cacao nibs from their husks. It is typically done after roasting, as the husks will come off easier. Some large-scale manufacturers do this before roasting. Beans are cracked, but not to the point that they become a powder and sent through the winnower. The nibs are then sent through a series of vibrating screens under a vacuum. This removes any of the light husks, while allowing the heavier cacao nibs to come through.

**Picture: cracker/ winnower used at [redacted] Chocolate**

### Refining and conching

Refining is the longest stage of making chocolate, it can take several days. Refining and conching are both done with a melanger. A melanger is made up of two granite wheels rolling onto a granite base of a metal drum. This is grinding the chocolate to a superfine consistency. This is necessary because chocolate is a preparation that is meant to be smooth, and a particle size larger than 25–35 µm will be perceived as gritty. Once refining has been done for a sufficient period of time, conching must take place. Conching is the process of running the melanger with the lid off and the stones loosened. Instead of grinding the chocolate, the aim is for all undesirable volatile molecules to evaporate. The melanger is run until the flavour is appealing.

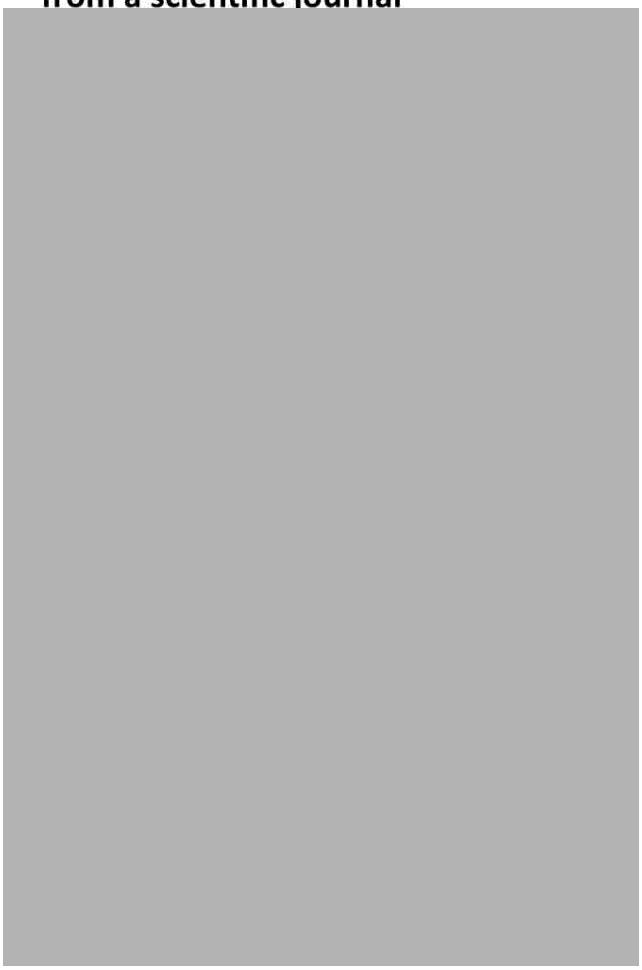
**Picture: melanger similar to the one used by**

### Tempering

Chocolate must be tempered to create a quality product. This is done by melting all of the fat crystals, and then holding the chocolate at temperatures favourable to the formation of desirable fat crystals. This allows a glossy bar of chocolate that is solid at room temperature and has a hard snap – all desirable characteristics.

I have an understanding of the process of tempering, but it is not thorough – it would not be necessary. chocolate has tempering machines that will create perfectly tempered chocolate, and any products I make are only proof of concept products. Pictured is a section of a report on chocolate from a scientific journal, given to me by . This report taught me most of what I know about chocolate.

**Picture: section on tempering from a scientific journal**



## Generating ideas to test (26 June)

This research during this stage allowed me to investigate many different ideas. I did research on current market products and sensory testing. Investigating a wide array of options is important to do at the start of product development, so that when you focus on something specific, you have ruled out other potentially good options. This allows your product to be as good as possible. Chocolate followed a similar process. She

began her brand development in much the same way, by surveying her friends on three different concepts.

**Picture: ideation brainstorm**

I began this phase of the project with a brainstorm, listing different ideas I thought fit the brief. I then annotated and highlighted my preferred ideas. I discounted a [redacted] flavoured product (orange chocolate) because [redacted] already sells an orange flavoured chocolate bar. I knew [redacted] had initially been quite interested in a [redacted] style product. However, after talking to her about the feasibility, she explained that creating a shelf-stable meringue-based product is not possible with the ingredients available in NZ. I also decided not to pursue [redacted] flavoured chocolate, as [redacted] though a nostalgic flavour for many, are no longer available for purchase. This means that snifter flavoured chocolate would potentially be unpopular, as it was an unsuccessful product for a much larger market than [redacted] I was initially worried that Turkish delight was set with gelatine, but it is set with cornstarch, so that was not a barrier (gelatine is an animal product, and therefore not vegan). I was worried about the feasibility of [redacted] bars, as I remember last year someone in my food tech class attempted to make something similar, and found it was not possible to cut up honeycomb consistently. I decided this was not a barrier, as I could experiment and potentially find a way to add the honeycomb directly to the chocolate. I was worried the kawakawa would not be easy to source, but I found other kawakawa products on the market, meaning that sourcing is possible.

Of all these ideas, I liked the idea of a [redacted] bar style product because hokey pokey is a very New Zealand flavour. I also liked the idea of a Turkish delight because that is a classic style of chocolate, and it would fit with [redacted] new line of caramels and pineapple lumps. I like the idea of a kawakawa chocolate because it is a very New Zealand flavour that is currently quite popular. This brainstorm helped me decide that these would be the three products that I would continue with for my conceptual design.

## Current market product sensory testing (1 July)

I undertook current market product testing with a focus group. The two conceptual trials I was most interested in were a hokey pokey crunch style product, and a Turkish delight style product. To investigate the qualities of similar products on the market, I tested two hokey pokey, and two Turkish delight style products available for purchase. The graphs displayed illustrate the results of both surveys, with average sensory scores. To comply with all ethical and legal requirements, all the people I surveyed were informed of the allergens present in products and were of consenting age. These surveys informed me of the desirable traits present in available products.

**Figure: focus group sensory testing feedback – 2 types of hokey pokey**

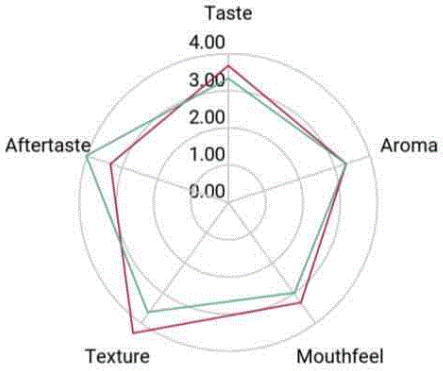
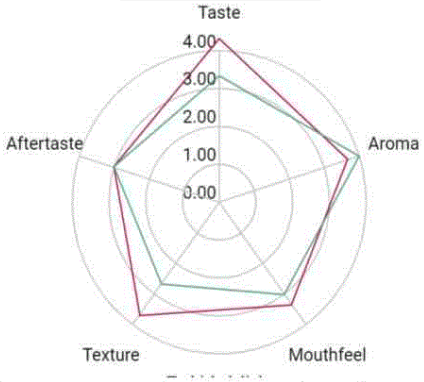



**Figure: focus group sensory testing feedback – 2 types of Turkish delight**




This gave me reference points for my own products when I developed them at a later stage. For example, the aroma of the Turkish delight I developed had an average score of three. Turkish Delight available on the market had a higher score. This told me that one of the key components of my Turkish delight, aroma, was missing.

## Current market product disassembly (1 July)

This product, and its dark chocolate counterpart, are extremely popular chocolate bars in Wellington. I decided to conduct a product disassembly on this bar because of its popularity, together with its similarity to one of the products I intend to progress into conceptual design - a hokey pokey chocolate bar.

**Picture: bar**

uses a relatively unique method for adding caramel brittle to this chocolate. Instead of being added directly to the chocolate, and being incorporated inside, the caramel is added in a thick layer to the back side of the chocolate. The caramel provides a lovely crunch and flavour and works as an addition where being directly inside the chocolate may not work. Being directly inside the chocolate could cause issues due to the small size of the bars. Having caramel on the usually plain backside also means that both sides of the chocolate have a pleasant look to them. The front side has the stamp of the moulds on it, and the other

side has the crunchy caramel layer on it. Another interesting feature of this product is the packaging of this product is a cardboard box with a silver foil inner. This is a change from the original packaging, which had a gold foil inner. The new inners are not as visually appealing, but are recyclable, meaning that the packaging is now fully recyclable.

**IDEATION, KEY OUTCOMES (01 July)**

- I decided to make three products for my conceptual design phase, to make sure I am not committed to just one idea. They are as follows:
  - Turkish delight with a m!lk chocolate coating;
  - M!lk chocolate and hokey pokey chocolate bar;
  - M!lk chocolate bar with kawakawa spice;
- I chose these concepts because they are in line with the interests of my stakeholder, [redacted] Each of these ideas offers something different;
- I also learnt a lot from the research in this phase. The sensory testing gave me reference points for the conceptual design phase, and the product disassembly allowed me to learn how I could potentially take an idea forwards to the conceptual design phase

# CONCEPTUAL DESIGN

After my ideation, where I generated ideas that could be tested, the next stage was to progress the three concepts that I chose to the conceptual design phase.

Those three ideas were:

- A hokey pokey crunch style chocolate, working with a very nostalgic, kiwi flavour;
- A kawakawa and horopito chocolate, using spicy, earthy flavours that honour Aotearoa; and
- A chocolate coated Turkish delight - another nostalgic flavour for many New Zealanders.

Testing three ideas at this stage of the project was pivotal to following proper technologist's practice. Once the ideas are modelled, and presented to the stakeholder, the best of the three can be progressed. If I had only focussed on one idea, which my stakeholder had not

liked, my project would have been cut short. Starting wide allows for a fully fleshed out project.

At this point in my project, I did not do extensive testing. I only tested with one stakeholder group, the technology teachers. This is because the products I was making were simply meant to be proof of concept. I needed to make sure they were feasible, and then present my primary stakeholder, [redacted] with my ideas. Later on, more extensive, focus group testing took place.

## Hokey pokey m!lk chocolate bar (3 July)

I researched how [redacted] bars are made and discovered they use a piece of specialised machinery, a hot oil jet cutter. To solve this problem, I had to brainstorm how else I could use hokey pokey in chocolate, as without the specialised cutter, the hokey pokey will form inconsistent shards. Some products on the market employ the inconsistent look of hand cut hokey pokey as a clustered product - an example is [redacted] However, a product of this nature would not fit into the [redacted] brand. [redacted] sells a hokey pokey crunch chocolate bar, so one option was to explore creating a vegan version of that. My other option would be to follow the [redacted] route, placing the hokey pokey on the back side of chocolate bars.

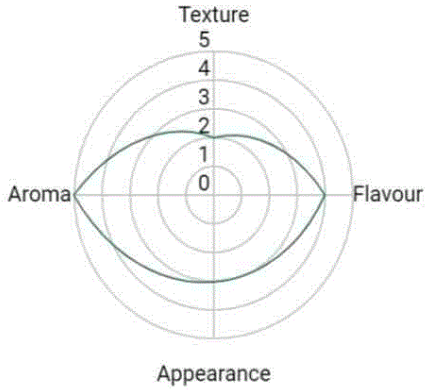
At this point in the project, I did not have proper chocolate moulds, and was making a bar as a proof of concept. I therefore decided I would make this in the [redacted] - hokey pokey chunks inside the chocolate. If I decided to continue my project with this product, the next step would be to explore a [redacted] chocolate bar.

### Method

I made a small batch of dry caramel hokey pokey, made up of golden syrup, sugar, glucose, and baking soda. allowed it to cool, and then incorporated it into tempered [redacted] plain chocolate. I used 9.6g of hokey pokey/100g of chocolate. I put the product into silicone moulds and allowed it to set overnight. The recipe for the hokey pokey was taken from the internet. I used a sugar thermometer to measure the temperature of the hokey pokey. However, the thermometer I used was faulty, resulting in an undercooked and therefore underset hokey pokey. The chewiness meant the product was not perfect, but it could still act as an adequate proof of concept. If I continued with this product, this stage would still yield multiple valuable lessons from making this product that I could apply later on. I learnt the importance of having everything ready when you start making the hokey pokey (such as a lined baking tray), as once the hokey pokey starts cooking, things can happen very fast.

**Picture: hokey pokey crunch chocolate concept**

**Figure: sensory evaluation of my hokey pokey crunch concept, stakeholder group, Technology Teachers**



My stakeholder group, the technology teachers, liked the idea. They agreed the execution was off but could be improved upon easily.

## Kawakawa & horopito m!lk chocolate bar (3 July)

**Picture: foraged kawakawa dehydrating**

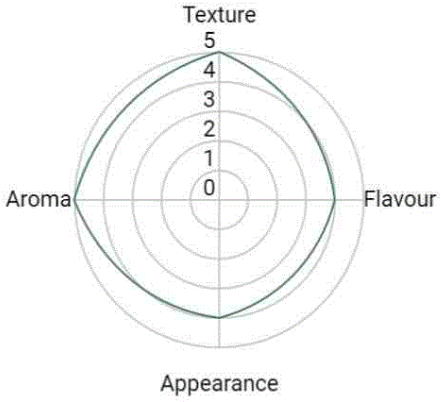
After deciding to make a kawakawa flavoured chocolate bar, I researched the flavour, and saw that it was often paired with horopito. After consulting one of my expert stakeholders, [redacted] who has extensive experience with Māori cuisine, I decided that this would make for a better chocolate bar. Horopito adds a gingeriness to the spice that Kawakawa contributes. I felt that these flavours would pair well with vegan milk chocolate.

### Method

I dehydrated and ground horopito and kawakawa, then added it to tempered [redacted] plain chocolate. The chocolate was 1.3% horopito, and 0.8% kawaka. I placed it in silicone moulds and allowed it to cool overnight.

As I was working with small quantities of the herbs, I struggled to get them finely ground enough, so if I continued with this product, I would need to work in larger batches to eliminate the problem. My stakeholder group, the technology teachers liked the product, but felt that more spice could be nice. My stakeholder group also felt that the flavour might be better paired with dark chocolate.

**Figure: sensory evaluation of my kawakawa and horopito concept, stakeholder group, Technology**




## Turkish delight with a m!lk chocolate coating (21 July)

To make this product, I researched other Turkish delights available, and all were coated in milk chocolate, making them not vegan. As I did some sensory testing with Turkish delight, I knew that aroma was one of the key factors. I decided I would need to use a significant amount of rosewater when I made it.

**Picture: enrobed Turkish delight**

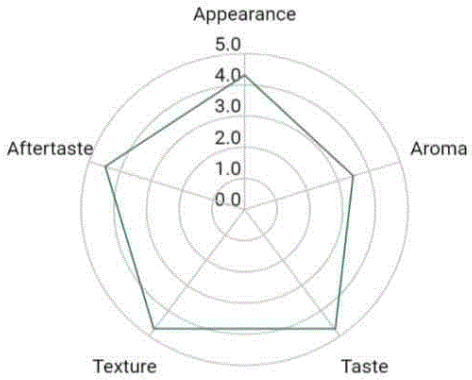
### Method

After making Turkish delight, and setting it in greased moulds overnight, I coated it in tempered [redacted] plain chocolate.

Coating a product in chocolate is called “enrobing” it. As I did not have experience enrobing, I struggled to get a consistent amount of chocolate on the Turkish delight. I also found that the grease coating on the Turkish delight meant the chocolate readily slipped off the Turkish delight. If I continued with this product, I would spend some time learning how to enrobe properly, and I would need to find an alternative to coating the Turkish delight in oil.

I tested the Turkish delight with my technology teacher stakeholder group. The feedback was that more aroma was necessary. The aroma of the Turkish delight on the market rated at approximately 4 for aroma in sensory testing, and the main feedback I got on this product was that the aroma was lacking. My focus group all liked the Turkish delight. The sensory evaluation pictured is the average scores from my focus group.

**Figure: sensory evaluation of my Turkish delight concept, stakeholder group, Technology Teachers**

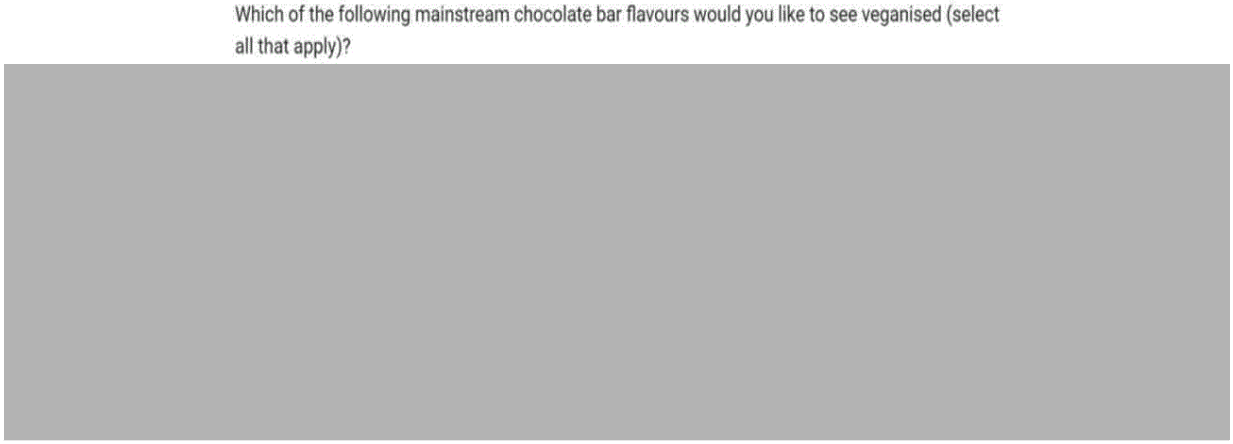



## Feedback on my three ideas from key stakeholder (21 July)

On the 21st of July, I contacted [redacted] with my proposed products to get some feedback from my primary stakeholder and move my project forwards. I detailed all my conceptual trials, and asked about her experience with anything similar, and any thoughts she had on the feasibility and viability of my products from both a technological perspective, but also a social perspective.

[redacted] **felt immediately that hokey pokey crunch style chocolate was the best option.** She felt it fit well with the [redacted] brand. She said the key thing to explore was getting the hokey pokey to work with her factory equipment. In her words, the hokey pokey would need to be “well integrated into the chocolate, [it] will need to be 2-3 mm in size to get through the machine’s pipes, which is quite small. It would be interesting to see how the hokey pokey performs if sprinkled on the underside of a bar – does it go sticky over time with oxidation?” This meant that if I did progress with a hokey pokey chocolate, I would have more specifications relating to the [redacted] factory setting, which would potentially take a lot of exploration. She told me that she had been interested in making a

**Figure: previous research by [redacted] showing clear flavour preferences**



hokey pokey chocolate and sent me her research showing that her target market was interested in it, pictured.

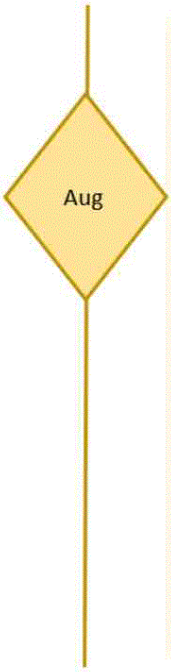
I **was not so keen on a kawakawa and horopito chocolate.** She felt that though this kai Māori style flavour is more popular, it is more serious, and "earnest" than what s looking to be.

loved the idea of a Turkish delight, a flavour she is a big fan of. Despite her personal preferences, when she conducted surveys prior to the launch of Chocolate on her target market, Turkish delight performed worse than all other flavours. **She felt that Turkish delight would be too niche for her brand.**

## CONCEPTUAL DESIGN, KEY OUTCOMES (21 July)

- As a result of feedback, I decided to continue my project by taking the m!lk chocolate and hokey pokey bar to the prototyping phase. Other products I had trialled (the Turkish delight and horopito and kawakawa bars) would no longer progress.
- This meant that I would need to spend time testing the best way to create this as a chocolate bar. Because machines need the hokey pokey to be smaller than 3mm if the hokey pokey is directly incorporated into the chocolate, the prototyping phase will be split into two distinct sections, each of which will need its own new specifications. I will need to prototype the hokey pokey itself, but also the incorporation of the hokey pokey in a way that was compatible for the factory setting.
- and I agreed the following specifications for the **hokey pokey** and **incorporation** of the hokey pokey **into a chocolate bar** (in addition to the specifications set out in the last stage):
    - The hokey pokey and chocolate bar must align with the values of (all ingredients ethically sourced);
    - The hokey pokey must have a hard crunch;
    - Cost must be considered in the selection and manufacture of the hokey pokey;
    - The hokey pokey must have a pleasant flavour;
    - The hokey pokey and chocolate bar must be gluten free;
    - The chocolate bar must be crunchy;
    - The molten chocolate must have a particle size finer than 3mm; and
    - Neither the chocolate nor the hokey pokey must over power the other.

# PROTOTYPING




**PURPOSE**

A – developed suitable hokey pokey – safe, ethical, vegan, to meet **key stakeholder specifications**

B – trialed methods for incorporating hokey pokey into chocolate bar to meet **key stakeholder specifications**

**MAIN TASKS**

**Research into the science** of hokey pokey

**HACCP Plan** created

Created **base hokey pokey recipe, 15+ trials** to find the best method

Findings captured and compared using a **standard template** to follow proper technologist practice

**4 incorporation methods created** and **sensory tested, stakeholder feedback** used to improve each of the methods – adjusting chunk size and depth in chocolate

**Multiple trials** to learn how to temper chocolate

**KEY OUTCOMES**

▷ Hokey pokey recipe finalised – sweetened with golden syrup

**Rationale**: best sensory testing feedback, stable product

▷ Hokey pokey to be incorporated into chocolate in 5g chunks and 2mm dust

**Rationale**: incorporation method met key stakeholder specifications – produced a good hokey flavour in the chocolate and retained crunch

Prototyping is the functional modelling stage of product development where a product is refined to become the best version it can be. The prototyping phase involves following product specifications while evolving the product, making minor alterations to both processes and techniques until the final product perfectly meets all relevant specifications.

My prototyping phase began as a result of the feedback I received from my key stakeholder after my conceptual design phase. Once I had completed sufficient research on my overall product concept, made a chocolate from beans, tested a range of products, and made hokey pokey, I could begin testing and trialling different techniques and processes. As the majority of this work would be completed in a classroom or home kitchen, I was limited to what was achievable in such a setting. In industry, there is ready access to large scale manufacturing equipment that allows for more complete prototyping.

**My prototyping was completed in two key phases.** The first phase was developing and testing the hokey pokey, changing different ingredients, techniques and processes until I settled on a quality hokey pokey that met my specifications. The second phase was developing and testing the incorporation of the hokey pokey into a quality chocolate product. I needed to create a bar that met my specifications, something that may prove difficult. I had already identified that adding large chunks through the chocolate was not feasible, and there was a risk that other factory-related issues may arise. The two phases of prototyping had some overlap, but as I needed to create a good hokey pokey before I could begin testing methods of incorporation, hokey pokey prototyping came first.

I utilised subjective and objective testing. Most of my testing was either done with a focus group of people who were part of the target market for my product, or amongst my secondary stakeholder group, the technology teachers at [redacted]

## Objective testing

Objective testing is a form of testing that attempts to minimise subjectivity. Objective testing makes use of yes or no questions to remove judgement calls. It is theoretically

unbiased, though in practice this is not entirely true. I utilised objective testing when testing certain qualities of my hokey pokey and chocolate.

### Subjective testing

Subjective testing is the inverse of objective testing. It utilises opinions and comments that show a subject's point of view. Subjective testing may be asking a potential customer their opinion on a product. I mainly utilised subjective testing in the form of sensory testing, scales of preference, and hedonistic scales.

## The science of sugar – how hokey pokey works (29 July)

I decided to continue with a hokey pokey chocolate bar, taking it to the prototyping phase. It was therefore important for me to understand how hokey pokey is made. The making of hokey pokey is a magical seeming process - sugar is boiled with water, causing the breakdown of sugar into many flavourful, aromatic compounds. The addition of bicarbonate of soda results in fine textured hard candy that has expanded to more than four-fold its original volume.

When I made hokey pokey the first time it did not work properly, and I struggled to understand why. I have had experiences in the past with hokey pokey having a grainy texture. Hokey pokey had always seemed like something outside of my control. By gaining a proper understanding of how hokey pokey is made it became a predictable experience that I have control over.

This was an important part of my process as I had to create a foolproof recipe to give to my stakeholder. This would not be possible if I did not understand the intricacies of the process.

My main questions, which I aim to answer in this section are:

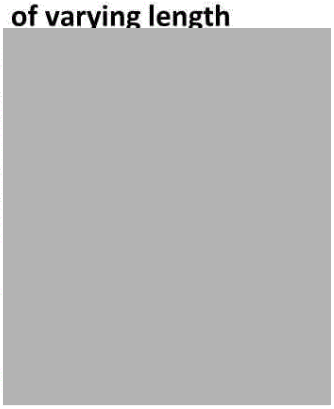
- What causes a hokey pokey to have a grainy texture?
- Why do hokey pokey recipes typically have multiple types of sugar, one usually being a syrup?
- Why does hokey pokey go soft extremely quickly - more so than other hard candy?
- Why does bicarbonate of soda work as a leavening agent?
- Why does hokey pokey often have a slightly salty flavour?
- What role does water play in hokey pokey? Some recipes have it, others don’t. Recipes with water act noticeably different to those without. Why is that?

### Sucrose vs. glucose vs. invert – the effects of sugars on candying

Glucose (also known as dextrose) is one of the simplest forms of sugar. It is what all sugars and starches are broken down into before being metabolised by our bodies. Fructose, a sugar that naturally occurs in most fruit which is literally named fruit sugar (fruct + -ose), is one of the other most basic sugars. It is an isomer of glucose with the same formula but with a different structure. When one fructose is bonded with one glucose, sucrose is created, otherwise known as white sugar.

Sucrose can be cooked in an acidic solution, and it will break into its composite parts. This is known as invert sugar due to the optical properties of sucrose and the inverted properties of its composite sugars. Invert sugar is approximately 75% glucose and fructose and 25% sucrose. Sucrose, glucose, and invert sugar are the key sugars I used in the making of hokey pokey.

**Figure: glucose chains of varying length**



Pictured is a diagram of a glucose syrup, with each hexagon representing a glucose molecule. Short one to two unit glucose chains will taste sweet, but as the chains get longer, they become tasteless (the size is too large for our taste buds). These longer chains are formed due to glucose's inclination to form hydrogen bonds with itself. Long chains will get tangled with themselves and impede the flow of water. This property is what makes glucose pivotal to candy making.

When making a hard candy such as hokey pokey, controlling crystallisation is imperative. Hokey pokey is a non-crystalline candy, and sucrose will crystallise easily, so any steps that can be taken to reduce the possibility of crystallisation should be taken. Glucose, with its long chains that will readily impede flow of water, is ideal for preventing crystallisation in candy making. Long glucose chains, which do not crystallise, will surround the sucrose crystals, preventing them from forming large crystals. Invert sugar was the original interfering agent, preventing crystallisation.

Honey is a natural source of invert sugar, and both the glucose and fructose present in invert sugar will bond to sucrose crystals, preventing, or limiting crystal formation.

Sucrose, the pivotal component in any candy, is what makes candy what it is. If glucose is present in too high of a concentration relative to sucrose in a candy, the candy will always be tacky. Sucrose, when cooked to different temperatures, will set differently. The set of sugar is related to the water level, and as the sucrose percentage increases, so does the boiling point. Until the hard crack stage is reached, at which point the solution is approximately 99% sugar.

**Figure: sugar concentration in heated syrup**

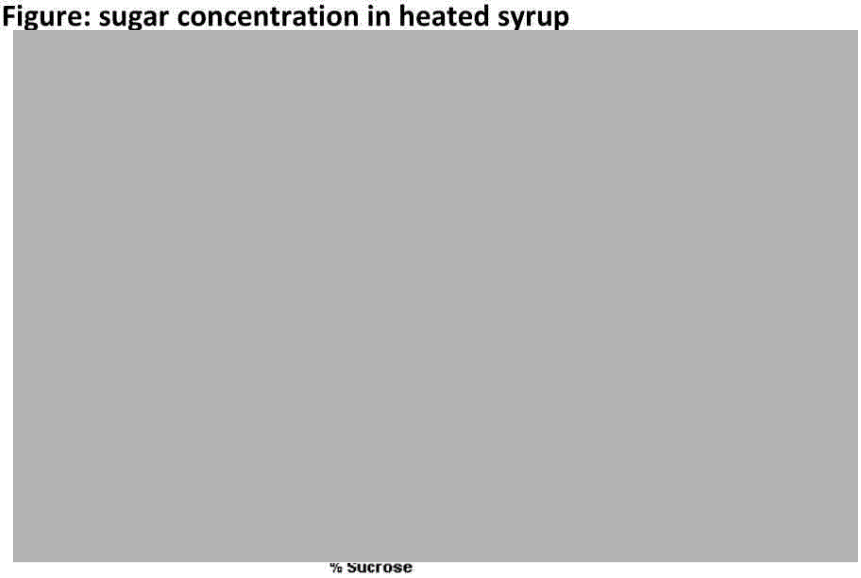


**Table: cooking stages of sugar**

By combining sucrose with a sugar that will interfere with crystallisation and cooking it to a point that all water has boiled off, a smooth textured, crunchy hokey pokey can be produced.

## Managing crystallisation

Sugar molecules are inclined to bond with other sugar molecules, forming large, dense crystals. Sugar wants to bond to itself, but in the presence of water it will dissolve, with water instead bonding to the sugar molecules. Once too many sugar molecules are present for the water to bond to, the sugar will begin to crystallise. Saturation point is the point at which no more sugar can be dissolved in water. The saturation point increases with temperature, meaning that boiling water will readily dissolve much more sugar than cold water can. At the point a hot saturated sugar solution cools down, the solution is supersaturated. This means there is more sugar dissolved in solution than could normally exist. A supersaturated solution will readily crystallise at even a slight disturbance. If crystallisation is not carefully managed in a non-crystalline candy such as hokey pokey, the candy will be rendered unusable. Crystals will form as the result of the presence of a crystal 'seed'. A crystal seed is a surface that the sugar can attach itself to, allowing crystal growth. Crystal growth in turn favours more crystal growth. Something as small as a piece of dust or the stirring of the cooling solution can cause crystal growth. Another common cause of crystal growth is the splatters of sugar on the side of the pan it is cooked in. For this reason, it is common amongst candy-makers to regularly wipe the side of a pan with a wet pastry brush to dissolve any potential crystal seeds.

In the case of hokey pokey, which is an extremely concentrated sugar solution at 1-2% water, it is cooled so fast that it becomes a non-crystalline mass of sugar molecules. By combining the method of wiping the pan, together with a significant proportion of an interfering agent such as invert or glucose syrup, a cook can effectively create non-crystalline hokey pokey.

## Managing hygroscopy

Hygroscopy is the ability of a substance to absorb moisture from the environment. This is commonly seen in silica gel 'desiccant' packets that come with dried goods, or the tendency of brown sugar to clump, even in a sealed container. These substances are absorbing the moisture from the air around them. Hygroscopicity is caused by a variety of things, including chemical makeup of a substance, surface area, and porosity. Due to sugar's strongly hygroscopic nature, it can present issues in the making of hard candy. Hard candy is meant to have a hard crunch to it as the name suggests, but if it absorbs too much moisture from the environment after being cooked it will go soft which is an undesirable outcome. This is even more so in the case of hokey pokey, which is also known as honeycomb or sponge toffee due to its fine textured, airy nature. Not only is hokey pokey almost entirely sugar, making it hygroscopic, but it has a porous texture and an extremely high surface area. This is

due to the fine bubble-filled texture. As such, it is extremely important to manage the water absorption of hokey pokey.

I have found three methods that are effective for managing water absorption in hokey pokey. By keeping hokey pokey in the freezer all environmental moisture is locked in place, and moisture may even be drawn out of the hokey pokey. A second option is to wrap the hokey pokey tightly in non-permeable PVC, but it will absorb moisture eventually. A final option is storing hokey pokey with silica gel, which is a common practice in the industry. This is potentially not feasible for my project due to the small, tight packets Wonderland Chocolate uses.

### Baking soda and hokey pokey

Baking soda or sodium bicarbonate ($NaHCO_3$) is one of the most common chemical leaveners in the world, known for its basic nature. When exposed to acid in solution, sodium bicarbonate will react to form bubbles and a salt. Surprisingly, when used in hokey pokey, sodium bicarbonate is working in an entirely different way, unrelated to its basic nature. Sodium bicarbonate is a salt, and as such, in the presence of heat it will decompose. Sodium bicarbonate in particular will decompose to form water, carbon dioxide, and sodium carbonate. This is the reaction that takes place when hokey pokey is made, and the sodium carbonate byproduct is why hokey pokey often has a slightly salty flavour.

### The role of water in candying

Water is boiled off when hard candy is made. So why is that water is often present in recipes for hard candy? Why is it that recipes without water produce such different results?

Cooking sugar to hard crack typically takes a long time. It cannot be left alone because it can very easily burn, but the temperature climbs very gradually. This is because most of the heat energy is being used to evaporate the water, and as such, the temperature does not climb quickly. Once the sugar syrup reaches quite high concentrations, the temperature begins to shoot up very fast. Failure to understand this characteristic of the chemical composition of sugar is a big mistake people make when candying, because the temperature rise is not a linear progression. If water is omitted, the sugar will begin caramelising almost instantly and will readily burn. If water is included, the process of cooking will take longer, allowing more control, and the caramelising will only begin once most of the water is boiled off, this means that the sugar will not over-caramelise or burn easily.

## Hazard Analysis and Critical Control Point Plan (1 August)

Before beginning my prototyping phase, it was important for me to have a Hazard Analysis and Critical Control Point (HACCP) plan. A HACCP plan is an important part of food production and is how biological, physical, and chemical hazards are managed. The plan identifies the critical points that hazards may be introduced, and puts in place controls to manage, monitor or eliminate them. I needed to have a HACCP in place before I began prototyping, as a wide range of people were eating my products, and it would be unethical to serve them potentially unsafe food.

**Table: HACCP Plan**

| Process | Hazard | Control | Corrective action |
|---|---|---|---|
| Preparation | Bacteria on clothes, hair, hands, leading to cross contamination. | Thorough hand washing.<br>Shaved head.<br>Clean apron. | Discard contaminated product. |
| Preparation of hokey pokey/chocolate | Poorly cleaned equipment. Unclean workstation. Inaccurate measuring. Foreign matter present in ingredients. Infestation of ingredients. Expired ingredients. | Clean all equipment before use. In a classroom, extra caution must be taken, as not all users of shared space will be using proper technologist's practice. Sanitise workstation.<br>All ingredients measured in grams, using calibrated scales suitable for the weight being measured.<br>Ingredients are inspected and sifted before use to check for foreign matter or infestation. Expiry dates checked. | Where controls have not been implemented, discard product. |
| Heating of hokey pokey | Moisture content not properly controlled, leading to pathogenic growth. Faulty thermometer. | hokey pokey cooked to 151℃. If thermometer gives incorrect reading, product will be noticeably soft. | Discard incorrectly cooked product. Calibrate thermometer. |
| Storage of hokey pokey | Moisture content increasing due to exposure to air, leading to pathogenic growth. Dirt contaminating product. Pest infestation. | Package the hokey pokey in a way that prevents air exposure; either tightly wrapped, vacuum packed, stored with desiccants, or in the freezer. If moisture content has increased, hokey pokey will be noticeably soft. Ensure any packaging is clean, and will not be susceptible to ants, or other pests. | Discard soft, contaminated or infested product. |
| Chopping and incorporation of | Moisture content increasing while exposed to air when | Work quickly, process hokey pokey at the latest stage possible. Test hokey pokey | Discard soft product. |

| Process | Hazard | Control | Corrective action |
|---|---|---|---|
| hokey pokey into chocolate | being processed, which can lead to pathogenic growth. | before incorporation with chocolate to ensure that it has remained hard. | |
| Preparation of cacao beans | Infested, or mouldy cacao beans, presence of pathogens on beans. | Remove any visibly mouldy cacao, any cacao moths that are present, or beans that will be large enough to not be pasteurised by roasting. Roast cacao to pasteurise. | |
| Refining of cacao | Foreign matter entering the chocolate. | Ensure melanger is clean. Leave it covered whenever possible. When not possible, supervise the melanger. | If foreign matter contaminates product, discard. |
| Packaging of chocolate | Poorly sealed chocolate may become infested or provide the environment for pathogenic growth. | Seal all bars using proper machinery and packaging. | If a bar is found unsealed, discard. |

## Hokey pokey prototyping

The phase of my project where I trialled different styles of hokey pokey was one of the longest, most rigorous phases of my testing. This was because hokey pokey is such an integral part of my product, and getting the hokey pokey right is what my chocolate is dependent on. Not only can the texture be difficult to get correct, but my focus groups demonstrated that other products on the market had a very mild flavour, described as biscuity. To avoid biscuittiness, I wanted to add flavour to my hokey pokey, and this proved difficult

The first hokey pokey I made was not a success. It was soft - a result of being undercooked - and was over caramelised. The recipe I followed was for a dry caramel, which is notorious for burning, and my thermometer was faulty. The next hokey pokey I made was based on a recipe given to me by [redacted], and it turned out quite well. I bought a sugar thermometer, which is made to accurately measure caramel temperatures, to deliver a more reliable result. After success with [redacted] glucose-based hokey pokey recipe, I began using it as the base recipe for all my subsequent hokey pokey recipes (I will refer to it as base hokey pokey). I did this by substituting like for like. For example, when making a golden syrup based hokey pokey, I substituted golden

**Picture: base hokey pokey**

syrup with glucose at a 1:1 ratio as they are both non-sucrose sugars and can be used interchangeably for this application.

After discussing my conceptual design phase with [redacted], I developed a new set of specifications for my hokey pokey chocolate. These were:

- Hokey pokey must be safe to consume;
- Hokey pokey must align with the values of [redacted] Chocolate (all ingredients ethically sourced);
- Hokey pokey must be vegan;
- Hokey pokey must work in a [redacted] bar;
- The hokey pokey must be visually appealing;
- The hokey pokey must have a hard crack;
- If the hokey pokey is incorporated into the chocolate, it must be no larger than 3 mm; and
- Cost must be considered in the determination of the hokey pokey

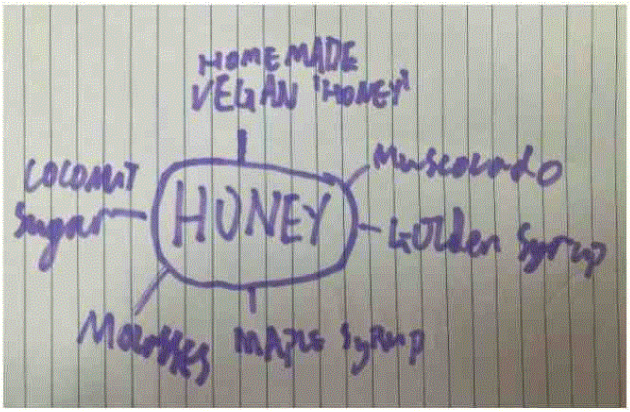
**Table: Base hokey pokey recipe, $0.38/100g, 5 August**

| Ingredient | Percentage |
|---|---|
| Sugar | 48.1 |
| Glucose syrup | 27.9 |
| Water | 20.0 |
| Bicarbonate of soda | 4.1 |
| **Method**<br>Add the sugar, water and glucose to a pan. Clean the sides of the pot and cook to 151°C. Remove from the heat, add the bicarbonate of soda and stir in. Pour into a lined tray and leave to cool, and set | |

After making this base hokey pokey, which worked well and did not need major improvements, I wanted to create something with a nicer flavour. I knew from past experience with hokey pokey that honey can add a stronger, distinctive flavour. I started experimenting by substituting honey into the base recipe. I made four different batches of honey hokey pokey with different honeys, moisture contents, and batch sizes. This modelling took place between 5 and 12 August.

I found honey gave excellent flavour which solved the problem of a neutral, bland tasting hokey pokey. But by using honey and solving one problem, a new one arose. Honey is not vegan. To solve this problem, I did extensive testing to emulate the flavour honey contributes with vegan options. To do this well, I had to brainstorm what options would work well as substitutes for honey. I largely focused on sugar syrups, as honey was a substitute for glucose syrup, but also included some substitutes for the sugar itself. The brainstorm is pictured.

**Picture: brainstorming honey substitutes**



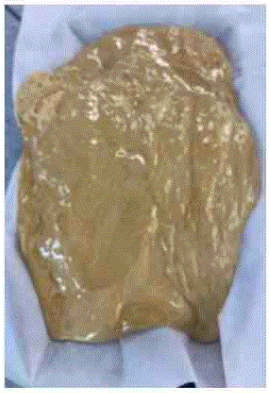
## Further development testing

**Picture: maple syrup, date syrup, coconut sugar hokey pokey (L-R)**

Between 12 and 20 August, **I conducted six trials.** I tested **maple syrup** in two different formulations, **date syrup**, **coconut sugar**, and two formulations of **vegan honey**. I did not test different batch sizes as part of these trials – I only did this when I found a batch I liked, and subsequently needed to test at scale. **The only batch that I liked was made with vegan honey** that I made by making a sugar, apple juice syrup reduced to half its weight. The recipe I found for vegan honey suggested the addition of chamomile tea to boost the honey flavour. I experimented with and without a tea bag. The addition of chamomile tea increases cost notably ($0.06/100g)). Though I liked the vegan honey with chamomile tea, **it was 2.4 times the cost of the original recipe**, and added very little, so I progressed with the non-chamomile version, which was not much cheaper.

I chose to disregard the price difference and progressed the vegan honey hokey pokey (no tea bag) to focus group testing. The focus group could detect differences between the vegan honey and the plain hokey pokey and showed a clear preference for the former. **But when paired with chocolate, focus groups struggled to discern a difference**. Because the difference was so subtle, I continued my prototyping.

**Picture: vegan honey hokey pokey**



I suspect the **coconut sugar and date syrup** batches didn't work (they both had a burnt flavour and did not contribute their characterising flavours) because all the **key flavour compounds were burnt off or evaporated** in the high heat of the caramelisation.

I believe the **maple syrup** batches, which also did not contribute their characterising flavours, **did not work because maple syrup is largely sucrose syrup**. Most syrups work as substitutes of glucose syrup as they are non-sucrose sugars (such as honey, known as the first invert-sugar).

## Final testing

After my extensive testing, I still did not have a solution to the issue of flavour. I had not been able to find a method to add a distinctive flavour to hokey pokey while keeping it vegan.

My final major round of testing, which took place from 1 to 3 September, was done with **golden syrup**. I hoped that the butteryness that it provides might be able to come through in the final product.

I decided to do a **small batch of golden syrup hokey pokey to see if it had any noticeable difference**, before going for a larger batch with a batch of basic hokey pokey to compare it to. When I made the small batch, I thought it did have a noticeable difference in flavour. I decided to make a larger batch (500g) and test it against a basic hokey pokey. I performed **blind taste tests** (to eliminate bias) with my food technology class, as well as stakeholders and experts, and the golden syrup hokey pokey was the clear preference. The **golden syrup hokey pokey was felt to be far more complex, buttery, malty, nutty**. The basic hokey pokey on the other hand, was felt to be much shallower and more muted, with a relatively plain sucrose flavour. When my secondary stakeholder group, the technology teachers tasted it, they felt it had a **"richer, fuller flavour"**, it "pair[ed] better [than plain hokey pokey] with milk chocolate." They felt that it "wouldn't be overpowered so easily" and tasted "richer and more caramelised" and "less like plain sugar."

**Picture: golden syrup hokey pokey**

After settling on golden syrup hokey pokey, while I was working on a later stage of prototyping, I realised that [redacted] prefers to use organic cane sugar in her products, rather than more refined sugars. I decided to do a test batch of golden syrup hokey pokey with **organic cane sugar**, on 21 September. While I thought it tasted the same, it was **tackier than it should have been**. Because of this, **I decided to use white sugar for my final hokey pokey**. This is not an issue, as the choice between cane sugar and white sugar was only a preference and not a specification.

**Picture: an unsuccessful hokey pokey made with organic cane sugar**

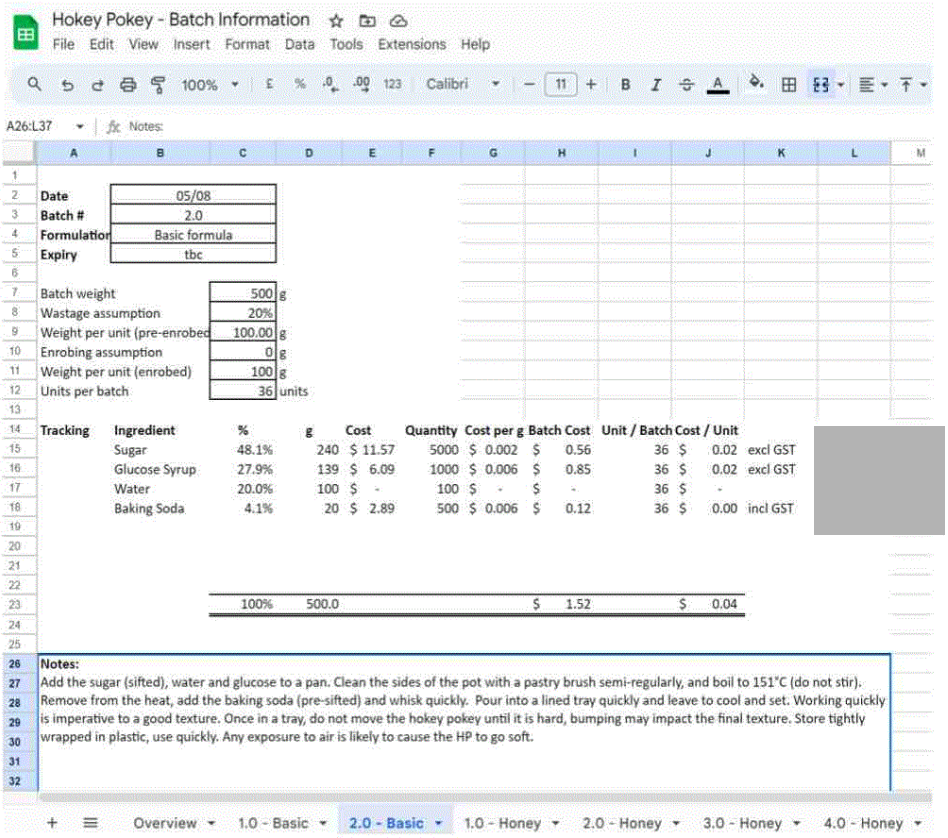
**As my project evolved, so did my method**. It began quite simply with all ingredients mixed in the pot, stirred, and heated, adding bicarbonate of soda, then poured into a sheet pan. I then had trouble with the bicarbonate of soda clumping, so I started sifting it in, or slowly stirring it in. These methods were not foolproof, and I eventually settled on using presifted bicarbonate of soda (it is mildly hygroscopic, and therefore prone to clumping), and whisking hard. It is important to work quickly at this stage, as the bubbles created by the bicarbonate of soda can be very short-lived. I quickly learnt that stirring and not wiping down the pot can cause problems with crystallisation. As a result of this, I stopped stirring the pot, something that is not necessary for a preparation such as hokey pokey, and I started wiping the sides of the pot with a pastry brush. I began sifting my sugar, a practice that removes any potential contaminants or clumps that will cook unevenly.

**I also struggled with my hokey pokey's shelf life**, it would quickly go soft, and not be suitable for use. I discovered that due to the high sugar content, hokey pokey is extremely

hygroscopic. As a result of this, I started tightly wrapping my hokey pokey's, and only cooking them shortly before I needed them.

**I wrote up every trial using a template** based on those that [redacted] used, to follow proper technologist's practise. The template is pictured. This allowed me to be professional in my communications with my key stakeholder and keep a consistent format in which my recipes were written up, allowing me to easily catalogue my recipes. The spreadsheet calculated cost in every batch, allowing me to easily compare costs.

**Table: example of technologist's record keeping**




**After a long period of testing, and the evolution of the hokey pokey, I decided that my hokey pokey would be made with golden syrup**. Doing so fulfils all my specifications for this section.

**Table: Golden syrup hokey pokey recipe, $0.38/100g (same cost as base recipe)**

| Ingredient | Percentage |
|---|---|
| Sugar | 48.1 |
| Golden syrup | 27.9 |
| Water | 20.0 |
| Bicarbonate of soda | 4.1 |

**Method**

Add the sugar (sifted), water and golden syrup to a pan. Clean the sides of the pot with a pastry brush semi-regularly, and boil to 151°C (do not stir). Remove from the heat, add the baking soda (pre-sifted) and whisk quickly. Pour into a lined tray quickly and leave to cool and set. Working quickly is imperative to a good texture. Once in a tray, do not move the hokey pokey until it is hard, bumping may impact the final texture. Store tightly wrapped in plastic, use quickly. Any exposure to air is likely to cause the hokey pokey to go soft.

**HOKEY POKEY PROTOTYPING, KEY OUTCOME (3 September)**

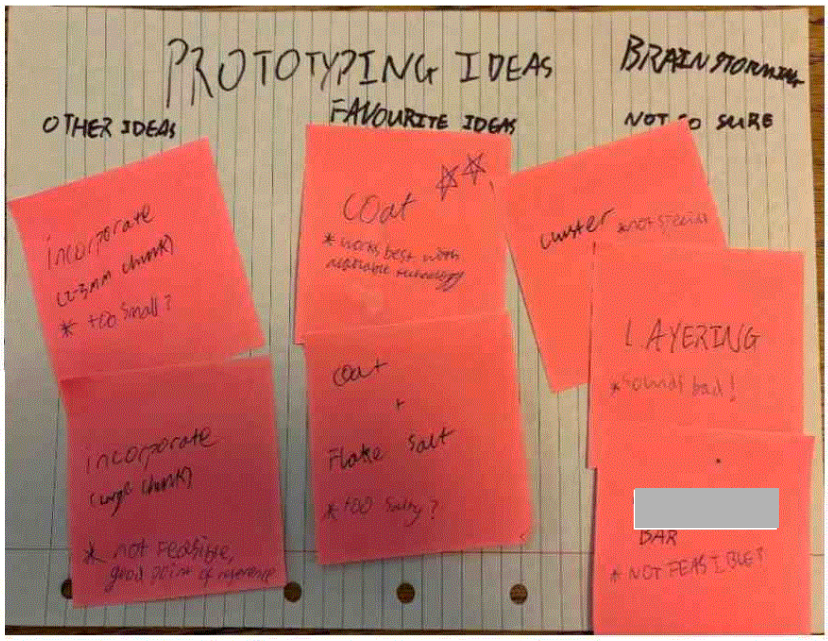
- My final golden syrup recipe was successful – cost was considered in the production and the final recipe met the specifications for cost, flavour, and being vegan. My key stakeholder was happy for me to proceed with this.
- This meant that going forward, all hokey pokey would be made using my golden syrup recipe.

## Hokey pokey incorporation in chocolate - prototyping

There were two points that required significant prototyping periods in the creation of a hokey pokey chocolate. There was the process of refining my hokey pokey technique and method until it fit the specifications perfectly. The other key stage in my prototyping process was **investigating how best to incorporate the hokey pokey into my chocolate**. This was important for a few reasons. Firstly, as explained earlier, hokey pokey is extremely hygroscopic. Because of hokey pokey's nature, it was very important to investigate how to add the hokey pokey while preventing it from going soft. **Keeping the hokey pokey hard is pivotal to its viability as a product.** The first batch of hokey pokey chocolate I did during my conceptual design phase had soft hokey pokey, demonstrating how fickle hokey pokey can be. The second major issue I had was that I could not put large chunks through the hokey pokey as I had initially intended. This is because [redacted] tempering machines require the texture to be less than 3mm.

Throughout these prototype testing stages of the project, **I used [redacted] milk chocolate. I did this because it has the same properties as [redacted] cashew milk chocolate but is not as cost prohibitive**. By using [redacted] I was able to perform extensive testing.

**Picture: brainstorm of potential methods of incorporation**




To begin this phase of prototyping, much like my conceptual design, I had to start quite wide. To do this, I **brainstormed how I could incorporate hokey pokey into chocolate**. The brainstorm is pictured. This allowed me to refine to a point where I was able to create a good product, something that would have been much harder without this initial process. Also pictured is a sketch of one of the potential methods of incorporation I considered.

This phase of prototyping consisted largely of making hokey pokey chocolate, consulting my stakeholders, the technology teachers at my school, and testing the products with focus

groups regularly, largely using subjective testing, but also implementing objective testing, in the form of asking if the hokey pokey was soft. I began this project by testing multiple ideas, listed in the following table.

**Table: feedback focus group on multiple products**

| Product being tested | Feedback from focus group (quotes) |
|---|---|
| A hokey pokey crunch style chocolate with the hokey pokey at 2mm, to fit [redacted] tempering machine (15% hokey pokey)<br>A hokey pokey crunch style chocolate with slightly larger chunks for reference | • "Subtle hokey pokey flavour"<br>• "Does not get stuck in teeth"<br>• "Good texture"<br>• "Not overbearing"<br>• "Distributed well"<br>• "Not enough crunch" |
| A chocolate coated hokey pokey cluster (19% hokey pokey) | • "Good hokey pokey flavour"<br>• "Nice crunch" |
| A chocolate with a layer of hokey pokey on top (similar to a product done by [redacted]) | • "Not enough flavour"<br>• "Little bit chewy" |
| A chocolate with a layer of hokey pokey, flaky salt on top | • "Addition of salt is a +"<br>• "Proper hokey pokey flavour"<br>• "Not enough crunch" |
| Ideas from focus group:<br>• "Combine 2 mm hokey pokey crunch with a layer of salted hokey pokey, this would contribute more flavour"<br>• "Consider layering in hokey pokey and chocolate"<br>• "Could store with desiccants" | |

**Picture: focus group testing**

**Picture: hokey pokey crunch style chocolate that I tested**

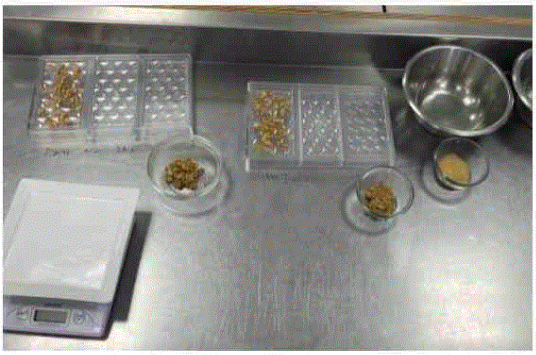
The focus group was made up of art and technology teachers, who are potential consumers of my product - they are part of [redacted] target market. The focus group contained my stakeholder group, the technology teachers, but was broader.

**After this first stage of prototyping**, which allowed me to collect stakeholder feedback and test the products, **I made decisions on how to move forward based on their feedback**. I decided against the addition of salt despite its positive reviews. This is because the inclusion

of salt brought my product too close to the [redacted], and I was trying to create a unique product. I also decided not to create a hokey pokey cluster. I did this because [redacted] is a chocolate bar, and a hokey pokey cluster would not fit [redacted] brief. Finally, I decided that fine grind hokey pokey (addition of dust to a bar) was not suitable on its own but would be worth investigating in conjunction with another option because it significantly increased the hokey pokey flavour of the bar. I decided to continue with the trialling of a layer of hokey pokey on top of the chocolate.

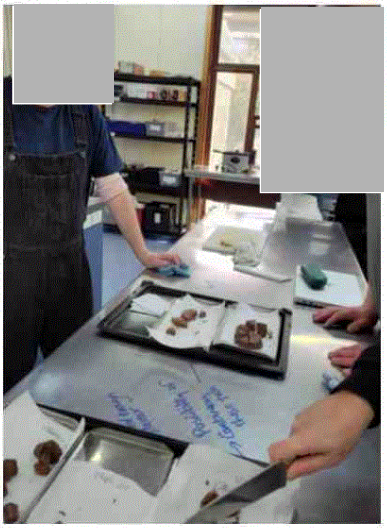
**My next prototyping was completed using [redacted] moulds on 04 September.** I had come up with the **idea of trialling chocolate bars with hokey pokey placed inside the grooves** of the moulds, as is pictured. Doing so would potentially enrobe the hokey pokey, protecting it from absorbing any environmental moisture, and given that the moulds are only 8.5mm deep, would potentially have the hokey pokey crunch style effect that inspired this project.

**Picture: set up for hokey pokey chocolate bars, hokey pokey inside the grooves of the moulds**



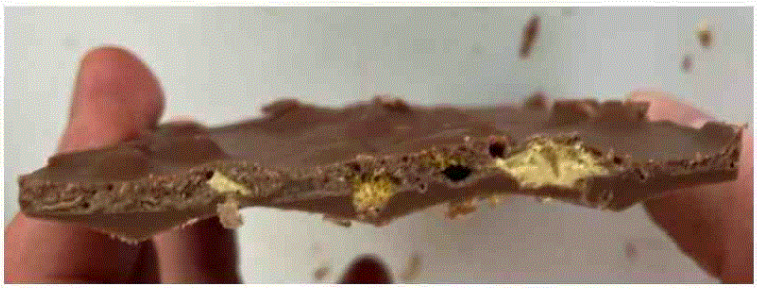
Based on this new concept, **I trialled chocolate in two different styles**. The first was a [redacted] **style bar**, with the hokey pokey on the flat back of the chocolate bar. The second style was based on my new concept - a **chocolate with the hokey pokey in the grooves**. With both of these chocolates, I trialled a version with **2 mm hokey pokey 'dust' (10% of chocolate weight)** incorporated directly into the chocolate to give a more intense flavour. These chocolate bars were again presented to the focus group for feedback. The focus group was also presented with a milk chocolate for reference.

**Picture: focus group testing**



The focus group again had negative reactions to the hokey pokey on top. They felt that the texture was off. People enjoyed the chocolate with hokey pokey in the grooves of the moulds the most, and when combined with the hokey pokey dust, it was by far the most popular. One taster said that unlike the other batches, it had "great texture, hokey pokey still crunchy, lighter". Comparatively, when the hokey pokey was on top, people felt the "most of the hokey pokey had gone sticky" and the "texture was wrong." **People also said that the hokey pokey with dust boosted the hokey pokey flavour, while still having the desirable textural element**.

**Picture: cross section of chocolate bar with hokey pokey chunks in the grooves**



This round of focus group testing was done with seven people, who each voted for their favourite of the products and gave feedback.

**Picture: focus group testing set up and results**

**As a result of this round of prototyping, I decided that I would no longer progress a product where hokey pokey was layered on top of the bar**; it repeatedly went soft and created an unappealing bar. I chose instead to continue with incorporation of the hokey pokey with hokey pokey dust, as well as hokey pokey pieces in the dimples.

## Working with my key stakeholder to advance prototyping

For my next step of prototyping, I needed to work directly with my key stakeholder. This stage was similar to the end of my conceptual phase, as this product needed to be designed so that [redacted] could sell it. For this part of my prototyping, I made three different chocolate bars. This time, instead of using [redacted] milk chocolate, I used [redacted] dark chocolate, as [redacted] my stakeholder, is vegan. **I created 5 bars, all with hokey pokey inside the grooves. Two of them had no hokey pokey dust, two had 10% hokey pokey dust, and one had 5% hokey pokey dust**.

Even though the teachers I had surveyed were overwhelmingly in favour of the hokey pokey in grooves in combination with hokey pokey dust, there was a potential for this to cause issues for factory equipment as the 10% dust leads to a dramatic increase in viscosity. For this reason, I brought [redacted] some bars with no dust, some with 10% and one with 5%.

When I visited [redacted] with my chocolates, **I got some good feedback, and technological insight**. She said that one of her flavours, [redacted] which is coconut and vanilla based has a powder percentage of 7.2%, so she believed it was possible that the increase in viscosity might be manageable. She brought up the point that the addition of my dry ingredients is likely cooling the chocolate somewhat, which will be partly what causes the viscosity increase. For the addition of hokey pokey dust to be technologically feasible, this meant it would need to be added at the start of the tempering of the chocolate. For my trial bars, I was adding the dust at the end. This meant **I needed to explore whether the hokey pokey could take being held at a high temperature**. [redacted] liked the 5%, and 10% bars equally, more so than the bar without any dust. She thought that the cross section from the bar with 10% dust was the best, and **the use of dust that would otherwise be a waste product was appealing to her**. We agreed that it may be worth investigating 2mm dust vs finely ground dust. She felt it would be good to get a more consistent size of chunk inside the bar. Based on this feedback I decided to explore some size standards, such as using a soil sieve. She also felt that the use of dark chocolate may have been why the batch I brought her turned out slightly differently from what I had expected, as dark chocolate has to be treated slightly differently.

## Further prototyping focusing on my key stakeholder's preferences

For my next stage of prototyping, I reverted to milk chocolate to allow me to continue to experiment with a product as close to the required specification as possible. **I made six bars – each containing 9.9g hokey pokey, with 5g inside the grooves, 4.9g of that as dust**.

This prototyping was done on 15 September. I was doing it to make sure I had my product perfect before progressing it. I used finely ground hokey pokey dust to explore its effects on viscosity. I also added the hokey pokey at the beginning of the tempering process instead of the end. This was because that is when the hokey pokey has to be added during factory production. I knew that by adding the cool hokey pokey at the end of tempering, it may have an outsized effect on viscosity (cooling the chocolate down), and by cooking the hokey pokey somewhat during the tempering process, there may be unintended effects.

I tried chopping the hokey pokey smaller, so that it would not impede the flow of the chocolate. I struggled to cut the hokey pokey to a consistent size or shape due to the shard-like nature of hokey pokey.

**When I used super fine hokey pokey dust and added it at the beginning of the tempering process, the viscosity was much lower than it had been with other trials.** I suspect this to be a combination of both the fineness of the powder, and the powder not cooling the chocolate. I also found that the dry crunch the 2 mm hokey pokey dust added was not present in the same way when I used superfine hokey pokey dust.

Chopping the hokey pokey smaller did not prevent the hokey pokey from impeding the flow of chocolate. I therefore **chose to explore the effect of 2 mm hokey pokey dust instead of finely ground dust, as the finely ground dust did not have the intended effect of adding flavour and dry crunch**. I **also explored chopping the hokey pokey differently**, and potentially spreading it out even more over the moulds. This was because large chunks of hokey pokey raised the risk of impeding the flow, therefore creating pockets of air in the bar which are not visually appealing. I considered whether it may be worth reducing the amount of hokey pokey.

**Picture: chocolate bar with air pockets caused by clumps of hokey pokey**

Pictured is one of the bars, with the pockets of air caused by large clumps of hokey pokey. There are also no visible specks, caused by 2mm dust, due to the fine grind of the hokey pokey.

My **final stage of prototyping** the hokey pokey incorporation was done over 21 and 22 September. I used [redacted] milk chocolate and made five bars. All of the bars **had 4.9g of 2mm hokey pokey dust.** Two of the bars had large chunks of 5g hokey pokey in the grooves, and the other three ranged from 3-5g of finely chopped hokey pokey chunks in the grooves. **This variation was done to test the effects of large and small chunks on allowing proper flow of chocolate, so there were no air bubbles**.

The result of this prototyping **demonstrated that 5g of large chunks of hokey pokey gave the best results**. The bars with smaller chunks did not yield the same crunch, and large chunks did not bunch together in the same way as those with smaller chunks, which caused the air bubbles.

**The surface of my chocolate was still not perfect, but I believed this was because I did not have much experience with tempering**. In addition, [redacted] told me that the surface of moulded bars tends to come out better with her machines than when she hand tempers chocolate.

I **decided the final product would use this method for the incorporation of hokey pokey – 5g pieces, incorporated in the grooves of the chocolate, with 6.5% hokey pokey dust**. This fits the specifications of my product as outlined below.

- The chocolate bar is visually appealing;
- The chocolate bar incorporates a nostalgic kiwi flavour;
- The chocolate bar is safe to consume;
- The chocolate bar meets [redacted] ethical standards;
- The chocolate bar is vegan;
- The chocolate bar is gluten free;
- The molten chocolate has a texture finer than 3mm;
- The chocolate bar is crunchy;
- The hokey pokey has a strong, pleasant flavour that is not overpowered by the chocolate it is incorporated into;
- The chocolate bar works as a [redacted] product; and
- The hokey pokey chunks do not interfere with the flow of the chocolate.

**Table: final chocolate bar process plan – 5g pieces of hokey pokey, incorporated in the grooves of the chocolate, with 6.5% hokey pokey dust**

| **Ingredient** | **Weight (per 75g bar)** |
|---|---|
| Hokey pokey | 9.9g |
| Chocolate | 65.1 g |
| Chop 5g of the hokey pokey into roughly 20 mm by 10 mm sized pieces. Distribute the chopped hokey pokey evenly across the mould, making sure it does not clump.<br>Roughly chop the remaining 4.9g of hokey pokey, and push through a chinois with 2mm holes. Set this hokey pokey 'dust' aside.<br>Partially melt the chocolate and add the hokey pokey dust. If the dust is added too early, and cannot be stirred through melted chocolate, it will form a thick layer on the heating element.<br>Temper the chocolate, by heating it to 45℃, then cooling it to 27℃, then heating it to 31℃. Pour this chocolate into the mould, tapping out any bubbles, ensuring corners are filled.<br>Cool the chocolate in the fridge. Once the chocolate can be seen from the underside to have drawn away from the mould, carefully turn it out, and seal. | |

**HOKEY POKEY INCORPORATION PROTOTYPING, KEY OUTCOMES (22 September)**

- I decided on the method for the making of my hokey pokey, and the method for the incorporation of my hokey pokey. I made these decisions based on sensory testing feedback with stakeholders and to meet the specifications of my key stakeholder. The method I chose for the hokey pokey production produced a stable, well flavoured product. The method I chose for incorporation into the chocolate meant the chocolate had a good hokey pokey flavour and good crunch. Both of these were important specifications of my key stakeholder.
- These methods are what I used going forward
- The methods that I laid out meet all the specifications outlined in key milestone/decision point 3
- As the methods for making hokey pokey, and incorporating it into a chocolate bar were decided on, my project could be moved forwards to production

# FINAL PRODUCTION PREPARATION

| PURPOSE | MAIN TASKS | KEY OUTCOME |
|---|---|---|
| Ensured product could be taken to market – marketable and safe | Development of **packaging**, including **branding** and **nutritional analysis**<br>**Check in with secondary stakeholder** – positive feedback<br>**Process plan** to meet health and safety requirements<br>**Shelf-life testing** | ▷ Health and safety plans requirements fully met<br>▷ Final name and packaging approved by key stakeholder and secondary stakeholder |

## Developing packaging (25 September)

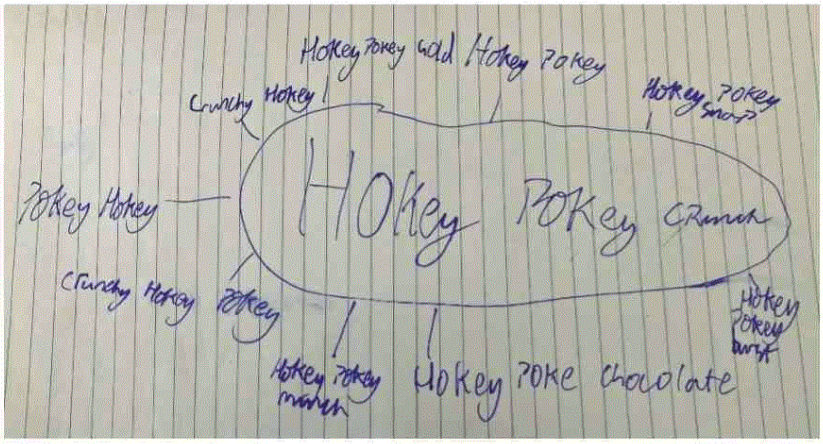
Packaging is one of the most important parts of a food product. It is the first thing anyone looking at the product will see, and it can be what convinces a potential buyer to purchase the product. As [redacted] uses plain [redacted] boxes that relevant information can be added to through the use of stickers, I have created packaging against a plain Jerry the Juggler box. I referred to other [redacted] products throughout the creation of my packaging, so that the packaging was consistent with [redacted] overall line.

**Picture: [redacted] package without stickers**

Pictured is a [redacted] packet without stickers. The specifications for my stickers are outlined below. As [redacted]er is a rotating flavour, stickers are simply attached to boxes. This allows [redacted] to customise what she sells, with as large of a production run as she sees fit.

It was important to suitably name my chocolate bar, which I have so far referred to as a 'hokey pokey crunch style chocolate'. Hokey pokey crunch is the name of the chocolate that [redacted] sells, and this is a unique product, and there would be trademark issues if I used the [redacted] title.

**Picture: brainstorm on potential title for my chocolate bar**




After some brainstorming - pictured, and referring to [redacted]s product line, I settled on Hokey Pokey Gold, and referred to the inclusion of golden syrup in the product description.

Before I could begin creating my own label, I needed to research the food safety and certification regulations on labelling. An example of this is the labelling on many of [redacted] "made without gluten". She uses this phrase on her label in place of certifications required to prove that her products are gluten free. This may be cost prohibitive for her.

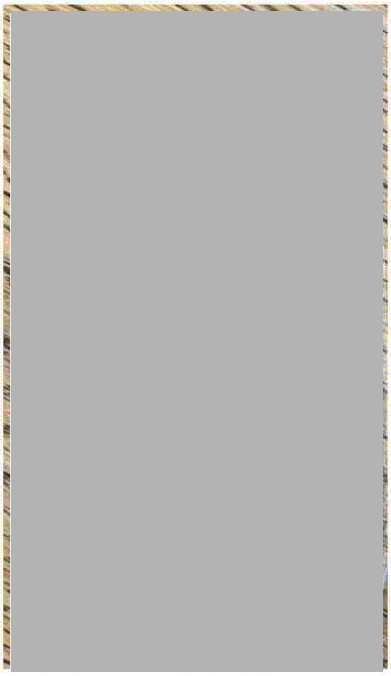
The relevant regulations that I found are as follows:

- All allergens must be in bold font;
- Any characterising ingredients must have percentages;
- Ingredients must go in order from highest proportion to lowest; and

- All nutrient values should be rounded appropriately.

Pictured is a sticker that was attached to the back of a [redacted] packet. My labelling specifications were:

**Picture: sticker that my packaging was based on**



- A sticker with the name of my product for the front;
- A sticker with the title and a 'fun' story;
- An ingredients list, nutritional information, a barcode, space for a best before sticker, storage instructions, and information about the factory;
- The back sticker must be 13.3 cm by 7.5 cm;
- The ingredients list must have allergens in bold font;
- The ingredients list must contain percentages for "characterising ingredients" which are ingredients that customers may want to see (e.g. to compare cacao solid percentages in chocolates);
- Nutritional information must be made for 25g servings, and per 100g;
- Nutritional information must follow the template of:
    - Energy (kJ)
    - Protein (g)
    - Fat, total (g)
        - saturated (g)
    - Carbohydrate (g)
        - sugars (g)
    - Sodium (mg).

To create the final nutrition information panel, I used a tool created by the Food Standards Authority, FSANZ. Information about the nutrition of my base chocolate was taken from the nutrition label of [redacted] plain milk chocolate. The nutrition label is below.

**Table: nutrition label for Hokey Pokey Gold**

| | **Per serving (25g)** | **Per 100g** |
|---|---|---|
| **Energy** | **522 kJ** | **2100 kJ** |
| **Protein** | **1.6g** | **6.6g** |
| **Fat, total** | **8.6g** | **34.5g** |
| - saturated | **4.6g** | **18.3g** |
| Carbohydrates | **13.6g** | **54.5g** |
| - sugars | **10.6g** | **42.4g** |
| **Sodium** | **50mg** | **198mg** |

After I had created a nutrition label, I spent a long time working to create a suitable product description. I then created a label using image editing software, doing my best to imitate [redacted] packaging. I use fonts that I found to be most similar to those that she uses and spent a lot of time working to lay it out the same way that her packaging is laid out.

**Picture: final packaging – "[redacted]"**

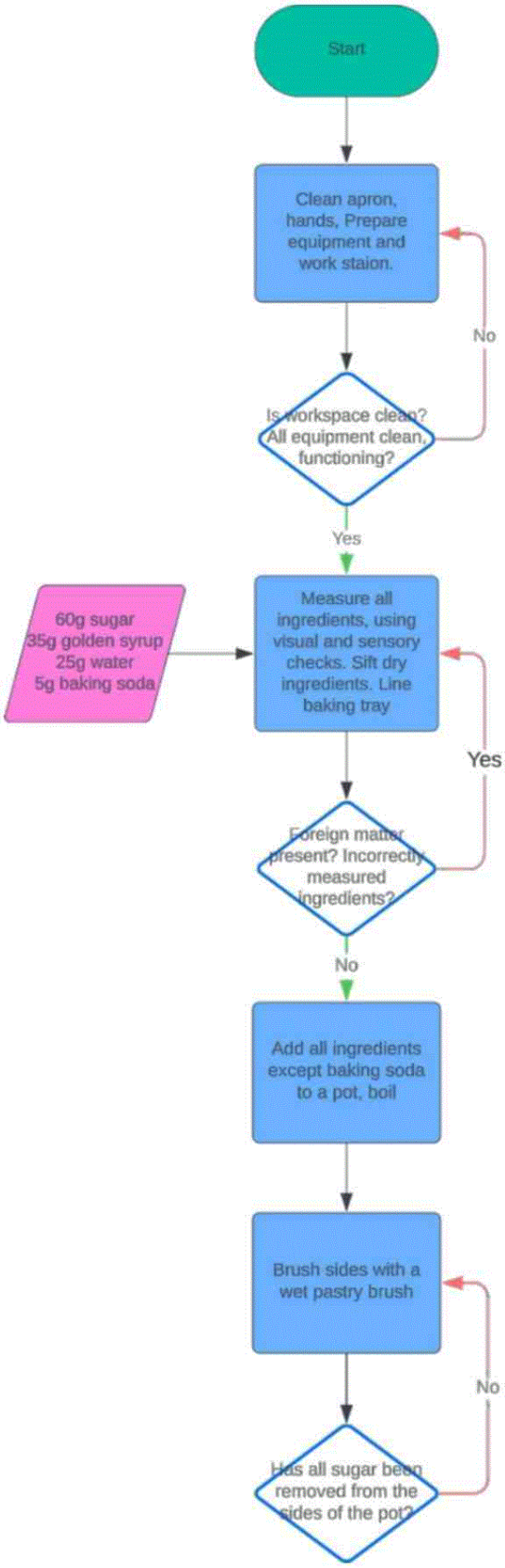
Once this packaging mock-up was completed, I reached out to my key stakeholder, [redacted] I presented [redacted] with my packaging, which she reacted positively to, stating that it had been done professionally and was ready for market.

## Check-in meeting with secondary stakeholder, [redacted] (27 September)

I met with my stakeholder, [redacted] to show her my product, and get her opinion on one of the final bars I made during the prototyping phase. This batch represented the final product as closely as possible except it was made with [redacted] milk chocolate. This was not a problem as [redacted] is not vegan. I was not going to be able to show her my final product before she left for a trip.

As a relevant stakeholder, [redacted] is a person who would potentially purchase products to market my school overseas. My project links to [redacted] and Wellington and helps tell a story that is relevant to her job. When I met with [redacted] I told her about my project, we tasted my product, and she talked about her opinion of it. When talking about her opinion of the product, we talked about if she liked it as a product, but also if she would, if given the opportunity, use the product on her overseas trips. [redacted] said that the size and shape were perfect, making a bar the right size to be a gift for an agent. [redacted] felt that the finish was professional, and the hokey pokey flavour was just right. [redacted] felt that the packaging was fun and a nice change from the typical [redacted] packaging (something she tries to avoid, as [redacted] is the standard NZ gift seen at international school fairs). [redacted] said she would

**Figure: hokey pokey process flow diagram**




certainly purchase my product for use as a gift in the future. She liked the inclusion of [redacted] on the packaging.

## Health and safety procedures (30 September)

Health and safety procedures are a very important part of the creation of a product. I was careful to implement all the necessary health and safety procedures at every stage of the project. When factory production takes place, it is even more important to follow proper health and safety precautions. Taking proper precautions to prevent cross contamination is also important. If the product is labelled as gluten free, and gluten contaminates the batch, a person with coeliac's could have a serious reaction.

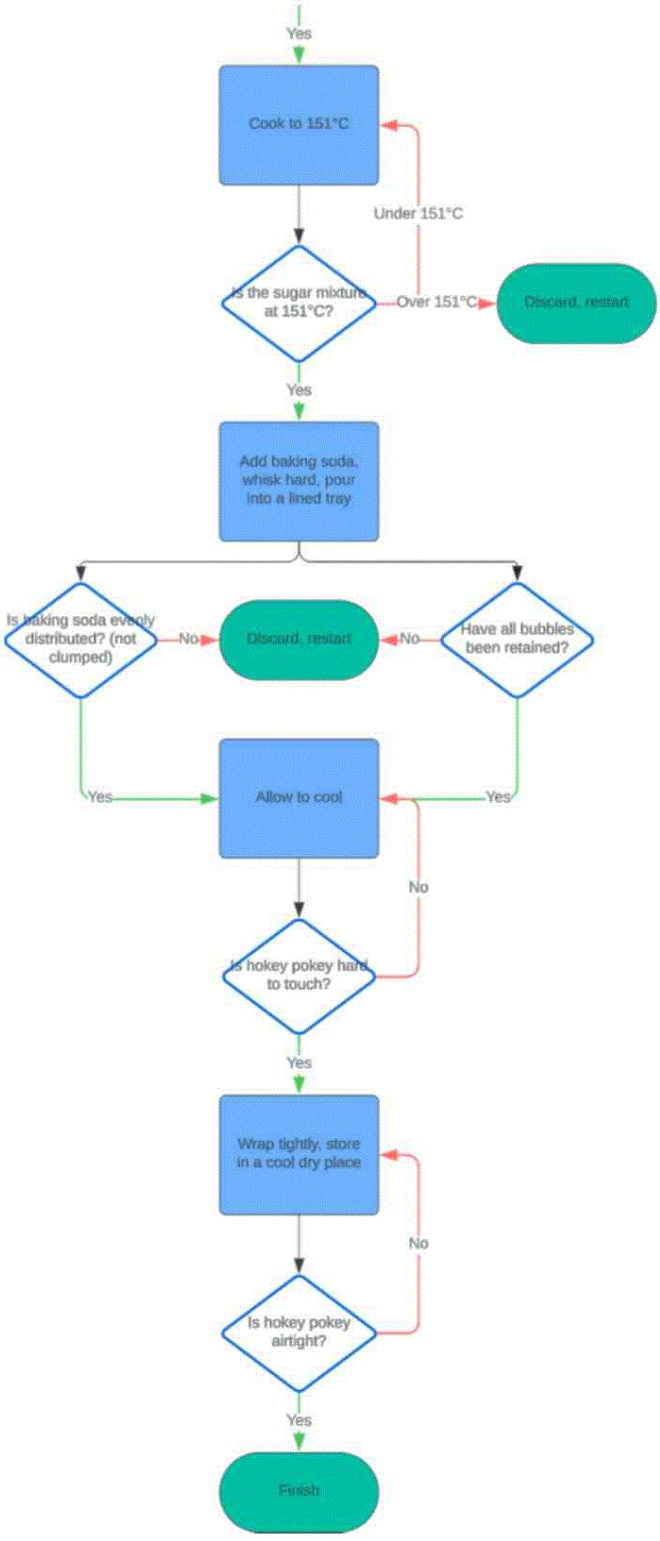
The two measures I have implemented to ensure proper health and safety procedures are a **HACCP plan** (shown earlier in the report) and a **process plan**. The HACCP plan ensures any hazards are managed, and creates check-ins at critical points, so that any hazards can be controlled. The process plan, which I developed alongside my product, ensures that proper health and safety regulations are followed, by detailing the method and ingredients for my product. It must be in depth to ensure that each batch is the same. By doing this, I am following proper technologist's practice.

I will not detail the chocolate making process in this scholarship report, as this process plan was developed with (and is intended for) my key stakeholder. I cannot share the method for making chocolate as it is based on the chocolate recipe developed and used by [redacted], who shared it with me in confidence. It is a trade secret.

The process plan for my hokey pokey is listed at the end of its section, and the making of the bar at the end of its section. I will not be doing full shelf-life testing, as that is beyond the scope and timeframe of my project, but I have written it up below, as it is still pertinent.

Pictured left is the process flow diagram for the creation of hokey pokey.

**Figure: hokey pokey process flow diagram**



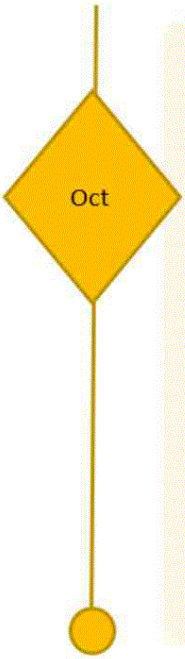

## Shelf-life testing (30 September)

Shelf-life testing is an important part of product development. It can be one of the longest parts of a project. There are sometimes processes using complex technologies that can be used to speed shelf-life testing, but it often requires food to simply be placed 'in situ' for long periods of time. **For [redacted] Chocolate, their products must have a shelf life of 6 months to a year.** [redacted] prefers all her products to have a year-long shelf life, but 6 months is the minimum for her stockists**. Because of this, my project is limited to creating a test batch of the chocolate, which will have shelf-life testing done by** [redacted] plan is to make my bar a 2025 Christmas release. Both [redacted] and I will perform shelf-life testing, by placing 4 bars on a shelf, where they will be held and opened at the 3, 6, 9, and 12 month mark. Pathogenic growth does not typically occur in chocolate. There is also little to no risk of critical chemical changes for chocolate products, unlike products such as a pickled food or a vitamin. Therefore, the type of testing that must be performed on my chocolate bars is subjective sensory testing. Colour, textural changes must be observed, as well as smell and taste.

**FINAL PRODUCTION PREPARATION, KEY OUTCOMES (22 September)**

- I produced packaging that met the requirements of [redacted] and regulations - nutritional analysis was completed.
- The name for my product was finalised: [redacted]
- Health and safety requirements were fully met - in addition to the HACCP I have a fully specified process plan: this allowed my product to be high quality and safe to consume.
- I received positive feedback on the product name and packaging from my secondary stakeholder and my key stakeholder. This meant that my product could now move into final production.

# FINAL PRODUCTION




**PURPOSE**

Made final chocolate bars to production standard as proof-of-concept

**MAIN TASKS**

Made **base chocolate** – vegan cashew milk chocolate using professional equipment; end-to-end process: from taste testing and selection of raw beans.
Managed all production of chocolate (1.7 kgs) myself, following Wonderland process

**Final product disassembly**

Made final bars –**final hokey pokey** to specification determined in prototyping, **incorporation into bars** as agreed with key stakeholder

**Shelf-life testing** for going to market in 2025

**KEY OUTCOMES**

- ▷ Final product successfully produced, bean to bar
- ▷ Shelf-life testing underway

This section presents a disassembly of the final ingredients used when going into production, and outlines the process of going into production, doing a batch test run, making chocolate from beans and working directly with my key stakeholder. Some parts of the method have been censored here to maintain confidentiality of [redacted] product.

## My chocolate: [redacted] cacao

[redacted] forastero cacao is the bean that I am using. It is produced by Uncommon Cacao. The cacao is 'Ultra Premium', grown in Belize. This is the first high quality centrally fermented cacao exported to the US. The cacao is grown by 420 small farming families, 100% of which are Belizean. The tasting notes are:

- Milk Chocolate;
- Frangipane:
- Coconut; and
- Raisin

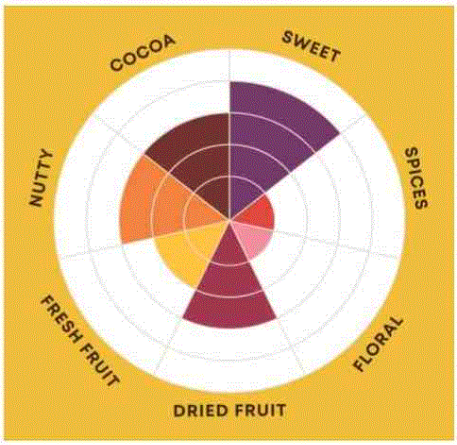
**Table: [redacted] cacao's efforts to help the local community**

**Community-focused initiatives:** Small monetary and in kind donations to local schools.

**Trainings conducted:** Farm productivity, ecological practices & cacao quality

| | |
|---|---|
| **Producers purchased from:** 450 | **Full time employees:** 9 |
| **Female producers:** 44 | **Full time female employees:** 2 |
| **Producers under 35 y/o:** 80 | **Part time employees:** 10 |
| **Organic producers:** 450 | **Part time female employees:** 1 |
| **Total # of producers trained:** 450 | **Average farm size (ha):** 1.1 |
| **Total # of female producers trained:** 44 | **Average sales per producer (dry kg):** 99.85 |
| **Total # of producers under 35y/o trained:** 80 | **Average annual cacao revenue per producer:** $330.09 |

**Picture: tasting wheel for [redacted] cacao**




Not only does Uncommon Cacao include in-depth product information and environmental information, but each cacao bean has in depth notes on the efforts Uncommon Cacao has made on creating a better place for the communities that supply them cacao, as well as those surrounding them. Notes for the [redacted] beans are in the table above.

## Final product, ingredient disassembly

In the creation of a product, it is imperative to fully understand the fine details of each ingredient. As such, I will investigate the purpose of each ingredient, this allows me to demonstrate my proper understanding of the product. This is especially pertinent given the nature of [redacted]Chocolate, a company that is trying to create additive-free products. If I can demonstrate the purpose of each ingredient, I can be sure that no ingredients have unnecessarily been included.

**Table: Hokey Pokey Gold final product disassembly**

| Ingredient | Purpose |
|---|---|
| [redacted] forastero cacao | Cacao beans define chocolate. Without the presence of finely ground cacao, chocolate does not exist. The highest quality beans will yield the highest quality chocolate. |
| Cacao butter | It is important to supplement cacao beans with butter, as the butter makes chocolate workable and gives it a smooth, buttery mouthfeel. Cacao beans are naturally 50% butter by weight, but a greater proportion of butter creates a more pleasant product. |
| Organic cane sugar | Chocolate needs added sweetener to be palatable. The sugar I have used is organic cane sugar as [redacted] prefers to use less processed ingredients where possible. |

| Ingredient | Purpose |
|---|---|
| Cashew | Cashew adds creaminess to the final product, functioning as a vegan replacement for milk. |
| Sugar | Sugar is part of the hokey pokey and is the core ingredient that is caramelised and set into a hard matrix. |
| Golden syrup | Golden syrup provides flavour to the hokey pokey - specifically, a deeper, richer, more buttery flavour. It also acts as an invert syrup, preventing crystallisation of the hokey pokey. |
| Baking soda | Baking soda causes the fine comb-like texture of hokey pokey. It does this through a salt decomposition reaction, creating carbon dioxide bubbles that are trapped by the hardening sugar. |

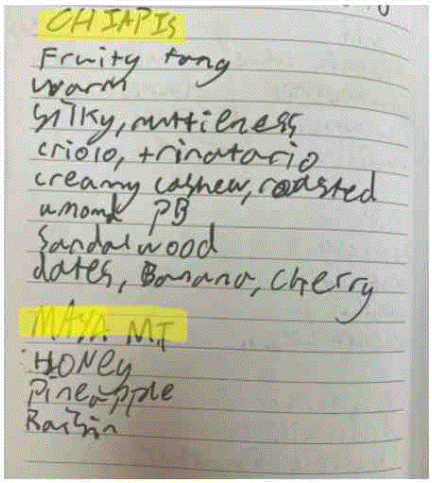
## Planning the 2kg test batch and selecting the ingredients

On the 22nd of August, I met with [redacted] to talk about the project and agree on dates to work together. We had agreed at the beginning of my project that a test batch run would be done together. **The test batch is a batch that is approximately 2 kg and is completed before full production for a few reasons. Recipes will sometimes have trouble scaling** from the quantities used in home kitchens, and scaling to a 2 kg batch ensures that the recipe will be able to scale. **Shelf-life testing is typically done with the test batch,** ensuring the feasibility of the product before a production run takes place.

The purpose of this first meeting was to check in on time frames and agree on how we could best work together for the test batch run. During our meeting, we talked about the process of making a base chocolate from scratch - choosing my beans, roasting them, cracking, winnowing, and refining them into chocolate. Making my own base chocolate would deliver the best possible result, paired uniquely to the hokey pokey flavour, and a good selling point for the bar.

**The test batch process began with choosing the beans.** [redacted] had a wide array of beans. My tasting notes are pictured. I inspected all the beans, looking for beans with good volume, and consistent size and shape. All beans that [redacted] uses are Transparent Trade and come from [redacted] Because of that, the beans [redacted] receives are typically of quite high quality and are unlikely to be mouldy or infested. To consider the taste, I snapped them open, while listening and feeling for a clean snap. I tasted each of the raw beans, comparing them to my tasting notes, and looking for beans that matched their tasting notes. I had to spend time doing this as any notes present in unroasted beans are very muted. One bean I decided not to use was Chuncho, which had orange blossom notes I felt would not pair well with hokey pokey. I avoided others that had quite acidic notes or significant smokiness. I settled on [redacted] forastero cacao beans. The notes present are:

**Picture: cacao tasting notes**




- Honey
- Raisin

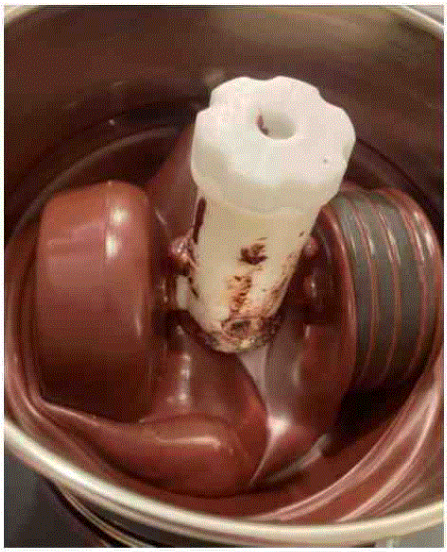
- Pineapple
- Milk Chocolate
- Coconut
- Frangipane

**I chose [redacted] because I could taste the fruity, caramelly notes described in the tasting notes, the beans were a good, consistent shape, and I did not detect any smokey notes, nor any overbearing acidity**.

Once I had selected my beans I sorted them. Any that were too flat, clumped together, too small, cut, or broken were removed. I then roasted them. [redacted] uses a [redacted] a coffee bean roaster that she has modified to suit her purposes. This is ideal as the beans are constantly being turned in the presence of an element. As long as size is consistent, this will ensure even cooking. **I roasted at P5, the lightest roast setting, for 18 minutes.** The beans were then left in the roaster for another 14 minutes, with the element off, to help them cool. They were left on a tray overnight.

The following day, I returned to [redacted] factory to **crack and winnow the beans**. The beans were put into a machine that cracked them and vacuumed away the husks. The nibs slowly came through into a bucket. I subsequently **sorted the nibs**, putting them in a large tray where they could be spread out, and I could remove any remaining pieces of husk. It is better to let a little husk come through the winnower than have the vacuum set too powerfully, as cacao is expensive. All husks are collected and donated to gardeners.

**Picture: my chocolate refining in the melanger lent to me**



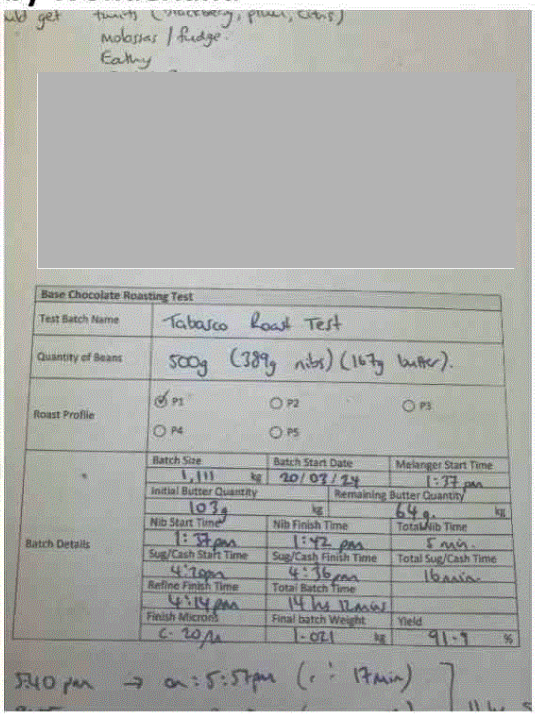
After I had finished sorting my nibs, I prepared for the next stage of the chocolate making, which would occur at home. With [redacted] help, I packaged the nibs, as well as other ingredients, including organic cane sugar, and cacao butter. [redacted] gave me four chocolate moulds, packets which chocolate bars could be sealed in, and her small batch melanger (pictured), which she uses whenever she does a test batch of chocolate, using the same method as me. My problem was that the process would take a very long time and the melanger would need constant monitoring as it is a fire risk. **The solution was to make the chocolate at home, and at school over multiple days, carrying the melanger back and forth with me. Because the refining is a long process, and it would be an inefficient use of time to do that at [redacted]'s factory.**

I began with 882g of raw beans, which after roasting weighed 870g, post winnowing, sorting, the nibs weighed 683g. This means my yield from roasted beans was 78.5%.

## Final production of the test batch

Production of the test batch of the bar occurred on 26 - 28 August. This phase happened while I was both at home and at school. I do not have my driver's licence so I needed to be driven to and from school with a heavy melanger so that I could run it for almost 20 hours. I needed to be present whenever the melanger was running because it is a basic piece of equipment and there is a risk it will set it on fire. I began refining my chocolate on the 28th

**Picture: test batch report by Wonderland**



Base Chocolate Roasting Test

| | |
|---|---|
| Test Batch Name | Tabasco Roast Test |
| Quantity of Beans | 500g (389g nibs) (167g butter). |
| Roast Profile | ☑ P1 ○ P2 ○ P3 ○ P4 ○ P5 |

Batch Details

| Batch Size | Batch Start Date | Melanger Start Time |
|---|---|---|
| 1,111 kg | 20/03/24 | 1:17 pm |
| Initial Butter Quantity | | Remaining Butter Quantity |
| 103g kg | | 64g. kg |
| Nib Start Time | Nib Finish Time | Total Nib Time |
| 1:37pm | 1:42 pm | 5 min. |
| Sug/Cash Start Time | Sug/Cash Finish Time | Total Sug/Cash Time |
| 4:20pm | 4:36pm | 16 mins. |
| Refine Finish Time | Total Batch Time | |
| 4:14 pm | 14 hrs 17 mins | |
| Finish Microns | Final batch Weight | Yield |
| c. 20/µ | 1.071 kg | 91.9 % |

5:40 pm → on: 5:57pm (: 17min)

of August. The technical details are in the table below. [redacted] refines all her chocolate to 20 µm. She measures this using a Hegman gauge, something I did not have access to at home. She advised that I should instead taste the chocolate, and finish refining once I could no longer feel any grit. The table below is based on the tables used at [redacted] to record test batches. This is done to record my test batch in the best way possible, following proper food technology practice. An example of a batch test given to me by [redacted] Chocolate is pictured. Quantities here, as well as one ingredient, have been redacted from the table, as I am using [redacted] chocolate formula which is a trade secret.

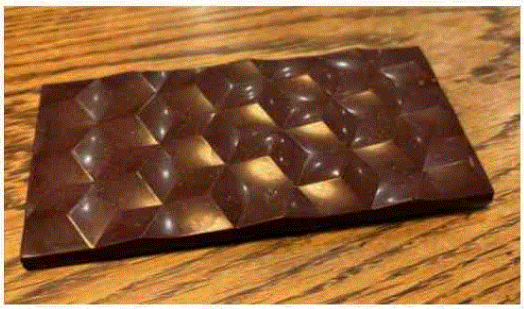
**Table: chocolate test batch report**

| | | | |
|---|---|---|---|
| Test batch name | [redacted] | | |
| Quantity | [redacted]g cacao nibs, [redacted]g cacao butter, [redacted]g sugar, [redacted]g [redacted] | | |
| Roast profile | P5 | | |
| Batch details | Batch size | Batch start date | Melanger start time |
| | 1.952kg | 27/08/24 | 15:04 |
| | Initial butter quantity | Remaining butter quantity | |
| | 146.5g | 146.5g | |
| | Nib start time | Nib finish time | Total nib time |
| | 15:05 | 15:34 | 29 min |
| | Sugar start time | Sugar end time | Total sugar time |
| | 19:33 | 19:50 | 17 min |
| | Refine finish time | Total batch time | |
| | 21:02 | 20:52:00 | |
| | Final batch weight | Yield | |
| | 1.715kg | 87.86% | |

Once I found the chocolate to have been suitably refined, after 19 hours and 56 minutes, I conched the chocolate for a further 56 minutes. The conching process allows undesirable volatiles to evaporate, meaning that only the best flavours remain in the chocolate. The conching process had a massive effect on the flavour of my product, which quite surprised me. The chocolate was then suitably packaged until I next needed it. Untempered chocolate

can be kept in a cool, dark place, and it will not spoil. This gave me a 1.715kg batch of base chocolate.
Pictured is one of my final bars, as well as a large number that were being kept in resealable vacuum pack bags, allowing me to store the chocolate safely.

**Picture: one of my final chocolate bars**



**Picture: multiple packaged chocolate bars**

I then made a hokey pokey, using the method I had settled on after my rigorous prototyping phase. The method is as follows.

| **Golden syrup hokey pokey process plan (100g batch)** | |
|---|---|
| **Ingredient** | **Weight** |
| Sugar | 60g |
| Golden syrup | 35g |
| Water | 25g |
| Bicarbonate of soda | 5g |
| **Method**<br>Add the sugar (sifted), water and golden syrup to a pan. Clean the sides of the pot with a pastry brush semi-regularly, and boil to 151°C (do not stir). Remove from the heat, add the baking soda (pre-sifted) and whisk quickly. Pour into a lined tray quickly and leave to cool and set. Working quickly is imperative to a good texture. Once in a tray, do not move the hokey pokey until it is hard, bumping may impact the final texture. Store tightly wrapped in plastic, use quickly. Any exposure to air is likely to cause the hokey pokey to go soft. | |

The method for the creation of a chocolate bar with hokey pokey incorporated is as follows

| **chocolate bar process plan (75g bar)** | |
|---|---|
| **Ingredient** | **Weight** |
| Hokey Pokey | 9.9g |
| Chocolate | 65.1g |
| **Method**<br>Chop 5g of the hokey pokey into roughly 20 mm by 10 mm sized pieces. Distribute the chopped hokey pokey evenly across the mould, making sure it does not clump.<br>Roughly chop the remaining 4.9g of hokey pokey, and push through a chinois with 2mm holes. Set this hokey pokey 'dust' aside.<br>Partially melt the chocolate and add the hokey pokey dust. If the dust is added too early, and cannot be stirred through melted chocolate, it will form a thick layer on the heating element. | |

| [redacted] chocolate bar process plan (75g bar) |
|---|
| Temper the chocolate, by heating it to 45℃, then cooling it to 27℃, then heating it to 31℃. Pour this chocolate into the mould, tapping out any bubbles, ensuring corners are filled.<br>Cool the chocolate in the fridge. Once the chocolate can be seen from the underside to have drawn away from the mould, carefully turn it out, and seal |

Another notable set of steps, which are not outlined here is the implementation of a HACCP plan. It would be inefficient to relist the steps I took, as they are detailed above.

The method I have just outlined is my final product in full. It has been developed to meet all my specifications,

- The hokey pokey dust provides a dry 'crunch'
- The hokey pokey chunks have not absorbed notable moisture
- The chocolate has a good flavour
- The chocolate is not gritty
- The chocolate product is safe to consume
- The chocolate product follows all laws and restrictions
- The chocolate product has a pleasant hokey pokey flavour
- The hokey pokey flavour pairs well with the chocolate
- The chocolate product is visually appealing
- The chocolate product incorporates a nostalgic Kiwi flavour
- The chocolate product meets [redacted]'s ethical standards
- The chocolate product is vegan
- The chocolate product is gluten free
- The chocolate, with hokey pokey dust, has a texture finer than 3mm
- The chocolate product fits into [redacted]s line as a [redacted]'
- The packaging incorporates a fun story
- The packaging follows all applicable regulations
- The packaging fits as part of [redacted] line

# PRODUCT EVALUATION

My final product meets all specifications well. Not only those that have been listed throughout this project, but also broader specifications. This section evaluates how well my specifications were met.

| Broad specifications | How these specifications were fulfilled |
|---|---|
| Technical feasibility | Throughout my project, I regularly consulted my stakeholder, who has experience with the equipment my chocolate would be going through during large batch production. I regularly made changes to ensure an uncompromised product that would not interfere with the equipment. When working with my stakeholder, I continued to make changes to the point we were both satisfied with my product's feasibility. All ingredients I used are available year-round and are not prone to shortages. For these reasons, I believe that my product is technically feasible. |

| Broad specifications | How these specifications were fulfilled |
|---|---|
| Long term viability | As the vegan market grows in New Zealand, the existing demand for [redacted] products will grow. I believe that I have successfully created a product for [redacted] line. As [redacted] who has a lot of business experience, specifically with companies such as [redacted] has found a niche in the market, I believe that my product will be viable as one of the products in the niche. |
| Social acceptability | [redacted] products all use extremely acceptable, ethically sourced ingredients. [redacted] goes above and beyond on the sourcing of their ingredients, and I believe that none of my ingredients take away from that. I have found that the flavour of hokey pokey is socially acceptable, at least in New Zealand, where the target market is. Hokey pokey is a very popular flavour nationally. |
| Shelf life | This specification is yet to be fulfilled due to the scope of my project. Due to time constraints, I was not able to undertake shelf-life testing, which would have taken a year after the end of my project. Shelf-life testing is underway to enable the product to be released in Christmas 2025.<br>I undertook short term shelf-life testing, to ensure that the hokey pokey would not soften immediately. The results of this were good but are preliminary. |
| Sustainability | My product uses soft plastic packaging, meaning it can be recycled, and a cardboard pouter, making it fully recyclable. [redacted] has put in a lot of effort to create sustainable products, and as part of [redacted] line, using their chocolate formula, my product is sustainable. Compared to non-vegan chocolates on the market, my product is much more sustainable. This is because cashew milk is used instead of cow milk. Cow milk utilises huge amounts of land and water, and results in much greater greenhouse gas emissions than plant-based milk. |
| Ethicality | At all stages of my project, I was careful to always maintain ethical practices. I followed a HACCP plan, as well as other health and safety precautions, and informed all subjects of all allergens present and any potential contaminants. I ensured that all subject's consented to benign in my survey, were of consenting age, and had information of how their results would be used. All subjects who are pictured consented to being photographed. I made sure to follow these steps throughout my process, ensuring that my project was ethical. |

| Narrow specifications | | How I met them |
|---|---|---|
| Hokey pokey | The hokey pokey dust provides a dry crunch | I undertook thorough functional modelling, testing different grind sizes with the hokey pokey dust, and found the best way to add hokey pokey dust that would not only provide flavour, but add to the crunch that the large chunks provide. Doing this also |
| | The hokey pokey dust does not interfere with the tempering process | |

| Narrow specifications | | How I met them |
|---|---|---|
| | | allowed me to explore the effects on tempering, and I was able to ensure that the dust did not interfere with the tempering process. |
| | The hokey pokey chunks have not absorbed notable moisture | By researching hygroscopy, and testing different methods of storage, I found that tightly wrapping the hokey pokey and using it with haste was the best way to ensure the hokey pokey did not absorb moisture. I also tested different amounts of hokey pokey chunks, to ensure that the hokey pokey did not interfere with t5he flow of the chocolate, causing bubbles in the final product. |
| | The hokey pokey chunks do not interfere with the flow of the chocolate | |
| | The hokey pokey has a good flavour | I performed extensive testing on the best method for making hokey pokey, which has allowed me to create a quality hokey pokey recipe with good flavour, a hard crunch and a non-crystalline texture. This entailed working with specialised sugar thermometers, researching the science of hard candy, and how temperature and invert sugar affect their final product. I also refined my method, adding steps such as wiping the pot while the hokey pokey cooks to further reduce the chance that the hokey pokey might crystallise. Throughout this testing, I trialled many different additions to create a flavourful hokey pokey, and the one I settled on not only had the best possible flavour but was as cheap as unflavoured hokey pokey. |
| | The hokey pokey has a hard crunch | |
| | The hokey pokey is not crystallised | |
| | Cost must be considered in the creation of the hokey pokey | |
| Chocolate | The chocolate has a good flavour | By using the roasting, refining and conching methods that [redacted] has developed, together with time and care in the home environment and personal research, the outcome was a product with a very high-quality flavour profile and a smooth texture. When I thought I had refined my chocolate sufficiently, I consulted peers to ensure that there was no grittiness. |
| | The roasting of the cacao should allow the best possible flavour to be present | |
| | The conching of the cacao should allow the best possible flavour to be present | |
| | The chocolate is not gritty | |

| Narrow specifications | | How I met them |
|---|---|---|
| | When cacao is sorted, all contaminants are removed | By carefully sorting through the cacao multiple times, I was able to ensure that not only were any contaminants that could affect health were removed, but also any contaminants that would negatively impact flavour were removed. |
| Overall chocolate bar | The chocolate bar follows all applicable laws and regulations | I spent time researching, and consulting stakeholders and experts familiar with food regulations. This allowed me to ensure that I followed all applicable laws and regulations. |
| | The chocolate bar is visually appealing | I spent time trialling different ways to incorporate the hokey pokey in the chocolate, and consulted my primary stakeholder, secondary stakeholders and others until it was a product we were satisfied with. |
| | The chocolate bar incorporates a nostalgic Kiwi flavour | Hokey pokey is a classic Kiwi flavour. |
| | The chocolate bar meets [redacted] ethical standards | I used cacao sourced by [redacted] and ensured that all ingredients I used were ethically sourced, including the cacao provided to me by [redacted] which was transparent trade, sourced from [redacted] |
| | The chocolate bar uses Transparent Trade cacao | |
| | The chocolate bar uses organic cane sugar where possible | The base chocolate uses organic cane sugar as a sweetener. I attempted to use organic cane sugar in the hokey pokey too, but it did not prove possible. |
| | The chocolate bar is vegan | All ingredients I used were gluten free and vegan, and all workspaces and equipment used were sanitised thoroughly to prevent any gluten contamination. |
| | The chocolate bar is gluten free | |
| | The chocolate bar has a texture finer than 3mm when molten | By refining the chocolate for approximately 20 hours and pushing the hokey pokey through a sieve with 2mm holes, I was able to ensure that the molten chocolate has a suitably fine texture for [redacted]s equipment. |
| | The chocolate bar is well received by stakeholders | Both primary and secondary stakeholders, as well as experts had very positive responses to the chocolate. By putting the product through extensive |

| Narrow specifications | | How I met them |
|---|---|---|
| | | functional modelling, I could ensure that my end product was of good quality. |
| | The chocolate bar holds up to initial shelf-life testing | Though long-term shelf-life testing is not possible within the scope of this project, initial shelf-life testing which I undertook at home showed that the hokey pokey was not softening.<br>Long term shelf-life testing is underway to enable the product to be released for Christmas 2025. |
| | The hokey pokey pairs well with the chocolate | I spent time testing different quantities of hokey pokey, until stakeholders, focus groups, and myself found the flavour to be pleasant and well matched. |
| | Neither the hokey pokey, nor the chocolate overpowers the other | |
| Packaging | The chocolate bar fits into [redacted] line as a [redacted] bar' | I investigated other products [redacted] has released under the [redacted] product line, and spent time talking with my key stakeholder, [redacted] about what she was interested in. Once I had come up with some ideas that I felt were suitable, I met with my key stakeholder again to ensure that she was satisfied with what I was creating. |
| | The packaging is congruous with [redacted] line | |
| | The packaging incorporates a fun story | I spent time reading the product descriptions and titles of other products by [redacted] and then consulted experts on the product description to refine it. Once I had done this, I approached my key stakeholder, and the product description and title were well received. |
| | The chocolate bar has a unique, fun name | |
| | The packaging follows all applicable laws and regulations | I spent time researching proper packaging standards and used FSANZ's online tool to create my own nutrition information panel. |
| Food safety | A suitable HACCP plan is implemented | I consulted secondary stakeholders and experts with experience creating HACCP plans and used my own prior knowledge to create and implement a suitable HACCP plan that I regularly referenced throughout my project. |

| Narrow specifications | | How I met them |
|---|---|---|
| | Proper technologists practice is followed throughout the project | By consulting with multiple stakeholders and writing up my functional modelling using formatting given to me by my key stakeholder, I was able to ensure that I followed proper technologist's practice. |
| | Cross contamination is prevented at all stages in the process | Through the implementation of proper health and safety precautions, including a HACCP plan, I was able to ensure that cross contamination did not occur at any stage during the manufacture of my product. |
| | The chocolate bar is safe to consume | I followed proper health and safety precautions to ensure the product is safe to consume. I implemented HACCP and process plans. |

## Personal reflections about this project

This project has been an amazing opportunity, and I am super excited to see where it goes. In talking with my stakeholder, we have agreed that if shelf-life testing yields a positive outcome, the product is set to be a Christmas release in 2025! has also offered me work in 2025. The experience of making chocolate bean to bar has been super informative and exciting. I have always been interested in food chemistry, but until this project, I was never able to wrap my head around the science of sugar or engage in a chemical food process to a high level of detail, learning that was super rewarding.

### Final stakeholder feedback

On the 16th of October, I met with to return the last of the equipment she had lent me, as well as give her some chocolate bars. I gave six chocolate bars, four of which will be used for shelf-life testing. The other two were for tasting, allowing me to get feedback on my final product.

responded extremely well to the chocolate. She felt that the amount of hokey pokey was perfect, and it came through well without overpowering the chocolate flavour that came afterwards. She thought that all the hokey pokey was properly enrobed, and there would likely be no shelf-life issues. showed me the Christmas release she was working on at the time of our meeting, and we talked about what this product would look like next year. said that when I was back from university, I could work with them to help make the chocolate bars. She said that she would likely do a double batch production run for my product as she thought it would be popular!

" worked on a special product for Chocolate as part of his Year 13 food technology scholarship paper. The brief to was to produce a vegan friendly m!lk chocolate inclusion bar that would have broad appeal, particularly at Christmas time. After some initial flavour research and development work, he landed on the concept of a hokey pokey inclusion bar. We were very supportive of this as it fits well with our brand and current flavour range – it's fun, nostalgic and a crowd favourite.

chose the cacao beans from a selection of origins and not only made the hokey pokey, but also roasted, cracked & winnowed and refined the cacao into a smooth m!lk

chocolate. He was meticulous in working out how to get the maximum hokey pokey flavour into the bar and landed on a formula that provided crunch for mouthfeel, but also a light dusting throughout the chocolate for an added flavour punch.
The resulting bar is a delicious, rich hokey pokey m!lk chocolate bar that we know will sell well. We have put samples of the bar into shelf-life testing and all going to plan will get [redacted] back to help us turn this into our 2025 Christmas bar!
[redacted] was great to work with. He was polite, grateful for time and resources and took the assignment seriously. I enjoyed working with him and I'm sure he has a bright future ahead of him in the food industry."

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