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Mana Tohu Mātauranga o Aotearoa
New Zealand Qualifications Authority

Scholarship Technology 2024

SCHOLARSHIP EXEMPLAR

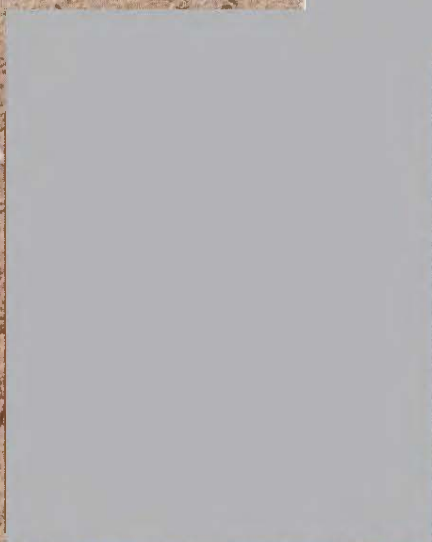
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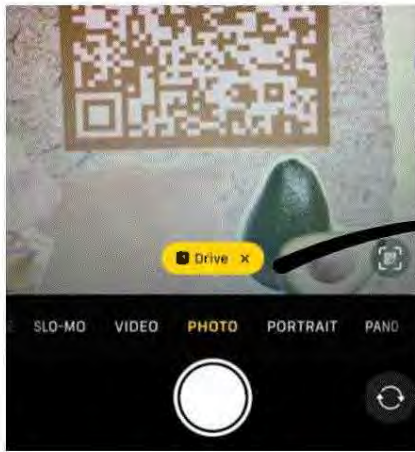
DiAPER



DILEMMA



QR Code



Using your phone's camera app, focus on the QR code and follow the Google Drive link that comes up to see a photo montage of my outcome.

Click Here to go to Drive



Introduction: Technologists of The Future

Technologists of the Future is a paradigm in which you are asked to rethink outcomes, question processes, and resort back to a pivotal concept of sustainability. There is a need for a new way of thinking; to respond to the pressing environmental crisis, and call into question the resources, processes, and pollutants of many design industries. It is key to focus on localised knowledge, renewable resources, and innovative methods to combat change. In a materials technology context, I have chosen to look at the processes of dyeing fabrics and clothing in childrenswear. Dyeing processes have changed and evolved to account for the rapid pace of fast fashion and the increase in consumerism within the fashion industry. Dyed in sweatshops in undeveloped countries, these clothes are not ethically produced, and the toxic chemicals are harmful to the environment and to humans. As a designer, and technologist of the future, I am called to do my part and respond to the environmental crisis by designing a sustainable diaper outcome for my client.

The Context

For my year 13 Materials Technology brief, my context is called '*Designers of the Future*'. This mantra challenges me to look into a wider worldview and think of innovative outcomes that could very well be what the future of the fashion world will look like in five, ten, or fifteen years. With climate change being greatly impacted by the waste produced by the children's wear industry, I challenge myself to re-design a sustainable, organic product, for the current children's diapers available on the market. I am critically questioning how to keep our planet from self-destructing from the ripple effects of this booming industry of childrenswear diapers. I seek to address kaitiakitanga, by using technological modelling, which is both functional modelling along with prototyping. Stakeholder feedback will inform my development to address this larger issue and my clients' needs.

The Issue

While researching Kaitiakitanga sustainability issues within the childrenswear industry, I was alarmed by a modern practicality that is detrimental for our environment; diapers. My issue focuses around the excess use and disposal of your everyday childrens diapers. Due to social factors, like children becoming potty trained later in their infancy, and modern parents having to work and leading generally busier lifestyles, disposable diapers are a convenient product with increasing popularity. While a couple extra years might not sound bad, when put into context, the average number of diapers used in a baby's first year is 2,500-3,000 diapers. The issue with disposable diapers is the fact that they are not biodegradable. The amount of waste from disposable diapers stays in landfill for approximately 500 years before finally breaking down. But, before their slow descent into nothing, they pollute the soil and come into contact with our waterway causing ripple effects in our environment.

Modern day diaper companies, such as [redacted] and [redacted], want to catch the attention of their target market, so they will use colourful prints on their diapers, typically including popular baby tv show characters on their designs so the kids will drag their parents into buying it. However, some, if not all, of the coloured dyes used on the fun prints contain heavy metals that can cause allergic reactions in babies. In a study done by Alberta et al. (2005), the dyes in diapers were found to cause diaper rash in babies, and it occurred only in places where the skin was in direct contact with the dyed part of the diaper. The symptoms were found to improve significantly with the use of dye-free diapers, with up to a third of babies and toddlers wearing nappies having nappy rash at any one time. This is a health issue that parents thought to be inevitable, however, the harmful chemicals in the dyes of diapers could

very well be the cause in many of these nappy rash cases, and even worse lifelong effects in their development that we are not yet aware of.

These harmful metals and chemicals are not only in the dye of disposable diapers, but throughout the entire design of the diaper. Using chemicals like sodium polyacrylate, dioxin, tributyltin (TBT), phthalates, glyphosate and more the diaper industry has been getting away with using these harmful chemicals for far too long. Babies, being particularly susceptible to the risks associated with exposure to harmful chemicals could not only attain nappy rash, but these chemicals could cause future issues in their development of nervous and reproductive systems, disrupting their sex hormones and other essential organs.

The Need

There is a need for change; A need to rethink what it is a parent really wants in their children's diapers. For my clients, [REDACTED], they are conscious parents, who are wanting an alternative to these harsh colourants and alarming chemicals found in their daughter [REDACTED] disposable diapers. I will address their need by designing and prototyping a diaper that is 'natural' in the sense that it is not dyed with harsh chemicals and it can be washed and reused. After critically thinking about possible solutions to this worldwide issue, I thought back to traditional cloth diapers, how mothers would wash and reuse them until their baby no longer needed diapers. This gave a singular diaper a much longer life cycle as one diaper could last you up to a year. As discussed in my GAPS and SWOTS analysis there is a need for this within the market, as there is a new wave of parents such as [REDACTED] who are wanting a product that meets their needs. Cloth diapers, being customarily made from natural materials such as cotton, hems, or wool, will have no problem biodegrading once their life-cycle has come to an end, leaving a clean carbon footprint. Using the idea of a traditional cloth diapers will stop this excessive diaper use, and possibly cut down a couple years of diaper use due to a quicker transition into potty training. The modern features on a diaper, including excessive absorbency for up to 12+ hours has stopped children feeling when they have wet themselves. They are then unable to form the crucial link between the action of excreting, and the feeling of wetness due to it. This slows down their development in outgrowing these diapers, and potty training becomes much harder. Although cloth diapers are very absorbable, they don't replicate a fake sense of dryness that modern disposable diapers do, allow for the baby to feel when it needs to be changed and form those crucial links in their brain, making potty training easier and come sooner.

Target Focus Group

I am hoping to offer a more natural and sustainable diaper into the market. My target group would be parents who are interested in premium quality products and are concerned about their carbon footprint when choosing their baby products. I think my target market would be financially stable parents who aren't too concerned about how much money they spend on these diapers in comparison to disposable ones because they're more concerned about their baby's health and the environmental impact. Their lifestyle could possibly be quite eco-friendly, they like to consciously do their part in helping the environment, and maybe they home compost and don't like to buy single-use plastic items. My diaper line would be sold in a more niche market like [REDACTED] where they sell other designer brands because they support sustainable and ethical baby products and they're all about naturally made products. The mothers that go into that shop are the ones likely to buy my product as they are going in here in search of something more natural for their babies, in comparison to mothers that buy their diapers at supermarkets they are probably looking for the cheapest disposable diaper, whereas the target market for nature baby wouldn't be ones that are looking for the greatest value or cheapest price it would be for consumers that are more concerned with the quality and sustainability of their product. The price point is different from supermarket price points where you can get a jumbo pack of 36 disposable diapers for \$25, in this shop you would probably buy one diaper for \$25, but you could argue that you can reuse it as many times as needed so, in the long run, it's cheaper.

Social Considerations

Socially, the diaper market is seeing a trend in eco and sustainable nappies. Manufacturers are increasingly focusing on producing diapers using biodegradable materials, reducing environmental impact, and enhancing recyclability. My sustainable, natural washable diaper meets this need of the upcoming social trends.

Specifications

- My product will:
- Be made from natural fabric - either cotton, merino wool blends, or another soft natural material
 - Link to my SDG number 13 in the broadest sense and therefore link to my issue of sustainability
 - Be dyed naturally in the colour dusty pink using avocado pip and skins
 - Be made for [] in the size range of 12-24 months age
 - Be washing machine-safe
 - Be socially acceptable to use at home and during tummy time/playtime
 - Have adjustable sizing - through pop studs to accommodate for sizes 12-24 months
 - Have a removable and washable insert for easy care
 - Have the correct child health and safety labels
 - Be finished by or before the 16th of October (the final due date)

Target Market

The target market for cloth diapers is a diverse target audience that includes environmentally conscious parents, those who want to save money on disposable diapers, and those looking for a more natural option for their baby's skin. The market has seen steady growth in recent years, with more and more parents choosing cloth diapers over disposable ones. My target group would be parents who are interested in premium quality products and are concerned about their carbon footprint when choosing their baby products. I think my target market would be financially stable parents who aren't too concerned about how much money they spend on these diapers in comparison to disposable ones because they're more concerned about their baby's health and the environmental impact. Their lifestyle could possibly be quite eco, they like to consciously do their part in helping the environment, and maybe they home compost and don't like to buy single-use plastic items. My diaper line would be sold in a more niche market like Nature Baby where they sell other designer brands because they support sustainable and ethical baby products and they're all about naturally made products. By making a naturally dyed reusable cloth diaper made from natural materials I am meeting the need of my niche target market because this is made from natural materials that are biodegradable and ecofriendly, helping them make an environmentally conscious decision, and my diapers will be of high quality and dyed naturally. Natural materials meets the need of parents who are concerned about the chemicals going on their babies skin as well as being dyed without chemicals. The ability to re wash and reuse them meets the need of parents looking for an economical product as they can use it multiple times and save money in the long run when in comparison to disposable diapers.

SDG Goal

My chosen sustainable development goal for my project was goal number 13 - Take urgent action to combat climate change and its impacts. There is a need for my product in relation to my SDG goal because my product addresses this goal by reducing the detrimental environmental impact that disposable diapers have. Taking 500 years to break down in landfill and in those 500 years polluting soil and waterways, disposable diapers don't meet the need of SDG number 13. Therefore there is a need for a diaper that does meet this goal that is biodegradable, can be used more than once, and is not made with harmful chemicals.

GAPS Analysis

In my gaps analysis I looked at 9 different diaper brands in the New Zealand market, 3 disposable diaper brands, 3 biodegradable diaper brands, and 3 reusable cloth diaper brands. From this research I found a gap in the New Zealand diaper market and that there is a need for a diaper made fully from natural biodegradable materials, that doesn't use chemicals to die, or make their diapers, that has sustainable, compostable packaging, that lists all the ingredients/materials involved in the making and that has a transparent supply chain.

THE NEED

for a naturally dyed reusable cloth diaper made from natural materials

Wider Stakeholders

To get an accurate representation of the features I need to add in order to address my wider stakeholders needs I conducted a survey for parents, my target market. 20 parents responded to this survey and given me a better idea of the need I need to address. What parents struggled with the most when changing diapers was their baby moving around a lot and excrement getting everywhere. My diaper will meet this need by designing features to help prevent this issue. Lots of parents answered that they were looking for a more absorbent diaper, so there is a need for a more absorbent diaper materials - possibly cotton or bamboo. Parents said a helpful feature to the packaging would be to add instructions with photos on how to put it on, so there is a need for this in my packaging. 90% of parents struggled with their babies nappy rash, my diaper will meet this need by being made of natural chemical free materials that are less likely to provoke nappy rash. Majority of the parents answered the reason they chose their specific brand of diaper was because of the quality, so I need to focus on the quality of mine ensuring it meets my target audiences preferences. The biggest reason why parents wouldn't buy my product is because of the tiresome hand washing, so to meet this need I'll make them washing machine safe and easy to take out inserts to wash them.

Cultural Considerations

Looking into Te ao Māori, a Maori world view for my cultural considerations, Te ao Māori is a holistic worldview that focuses on interconnections and is grounded in kaitiakitanga. As part of Te ao Maori and their beliefs, the Māori people are very connected to the earth as they believe that humans came from the Earth mother Papatūānuku, so returning the whenua to the land is a sign of respect and thanks. A traditional Maori custom after giving birth is to plant your placenta with a seed and grow a tree or plant with it in order to give back to mother earth. My product addresses this need of a Maori world view because it is made from natural biodegradable materials which means that at the end of its life, you can plant this diaper into the ground with seeds of your choice and grow a plant or a tree, giving back to mother earth and thanking her for the resources we took from her to make that diaper.

Social Considerations

As seen by the common uses of dyes in disposable diapers, there is a social demand for diapers to look good, adding in an aesthetic appeal into the once solely functional products. I aim to address this need by naturally dyeing my cloth diapers from food waste. I didn't want my cloth diapers to take away the clearly loved design dye aspect of disposable diapers, but I also didn't want to use dyes with harmful chemicals that increase your baby's chance of nappy rash. So, through research, I found a happy median; natural dyes. I was pleasantly surprised at the amount of colours you can replicate by just using fruits, vegetable skins and spices, and it meets the need of a metal free chemical free dye used within diapers, whilst pleasing my target audience of cautious parents wanting a natural alternative option in the diaper market.



Sustainability - Kaitiakitanga

In relation to my context of natural dyes and single-usage waste, acknowledging the need for my naturally dyed reusable cloth diapers, I want to address the Sustainable Development Goal (SDG) number 13. This goal is all about taking urgent action to combat climate change and its impacts. Through cloth diapers I am expanding the life cycle of a singular diaper from one use, to 500 years breakdown, to multiple uses and a breakdown of less than five years (depending on the natural materials). Not only am I preventing baby rash by using natural dyes, but I am also acknowledging the need for a chemical free diaper that I found in my gaps analysis. This is combating climate change and its impacts because if I had used a commercial dye, the harmful chemicals contained in it would leak into the solid and waterways once it's planted to biodegrade, defeating the purpose of biodegrading it.

Key Considerations

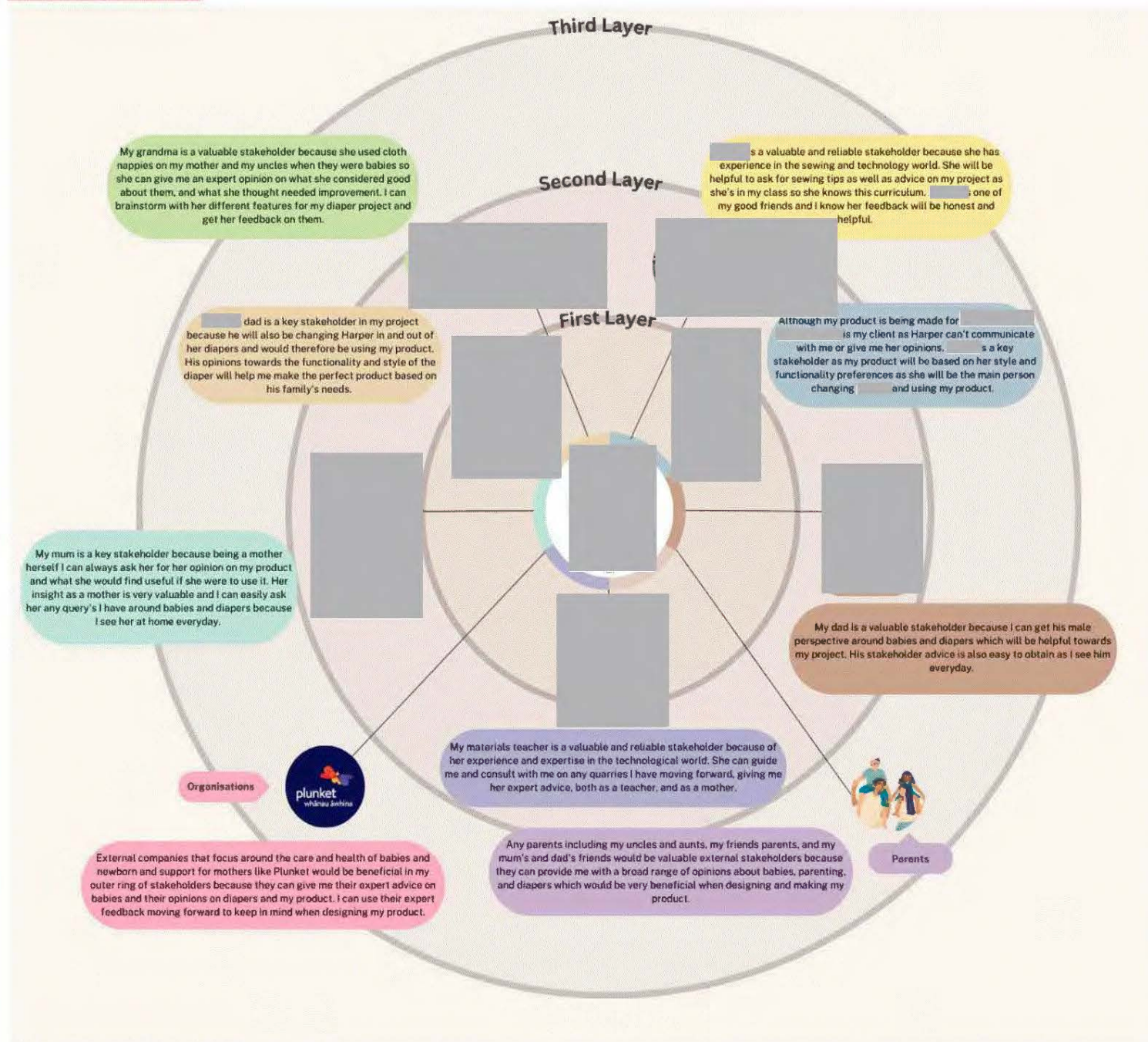
Stakeholders

In the centre of my stakeholder circle is my client, [REDACTED] who I have consulted with in essential points throughout my project to ensure I am meeting their needs and wants (likes and dislikes). My other stakeholders are [REDACTED] as she provides me with valid and reliable feedback regarding my skill set, my time and my resources. My parents, who will give me honest feedback and I can consult with about my constraints, my time as they know my out-of-school commitments. And [REDACTED] who will give me valid and guided feedback regarding my skill set and my constraints as she is experienced in sewing. I have also consulted with my grandma a lot about reusable nappies as she used them on my mum and her siblings so getting her opinion on how they could be improved is really valuable as she has reliable and honest feedback. I have reached out to the wider community of mothers as I needed community input from them to ensure consulting on the social acceptability around the fit of my diapers, the materials and components of my diapers, and the shape of my inserts. Finally, I have reached out to the wider community for stakeholder feedback, such as Plunket and local kindergartens to ensure my outcome is fit for purpose in a wider context if I were to expand my product into mass production.

Client

My brief this year required me to make my product for a mother who prioritises making sustainably conscious choices. [REDACTED] and their one year old daughter [REDACTED] were the perfect fit for my project as they were willing to work with me in order to create a naturally dyed, reusable, cloth diaper that best meets the needs of her and [REDACTED]. [REDACTED] has never used cloth diapers before, but she is willing to give it a go and use my product around the house as well as during tummy time and play time. What she's most looking forward to getting out of this project is reducing the amount of harmful chemicals that are in [REDACTED] diapers, and potentially avoid nappy rash because of it. After consulting with [REDACTED] through a questionnaire on her personal experience with diapers and her considerations around cloth diapers, I have been able to refine my design ideas, and narrow down the components/features I need to trial and test during my conceptual development stage.

Stakeholder Circle



Physical Environment

Since my target audience are babies aged 12-24 months, then my outcome could be used at kindergarten, in the playground, at home, or any other location that babies are generally in so I need to ensure my outcome meets the social acceptability and constraints of this environment. My client intends to use this product interchangeably with disposable diapers, mainly using it at home for convenience.

My Constraints

- Time: Be finished by or before the 23rd of October (the final due date)
- Equipment: Be made with the equipment in the materials room
- Skillset: I have never constructed my own pattern before and I will need to for the inserts
- Sustainability: Link to my SDG number 13 in the broadest sense and therefore link to my wider issue and brief

Clients/ Community Constraints:

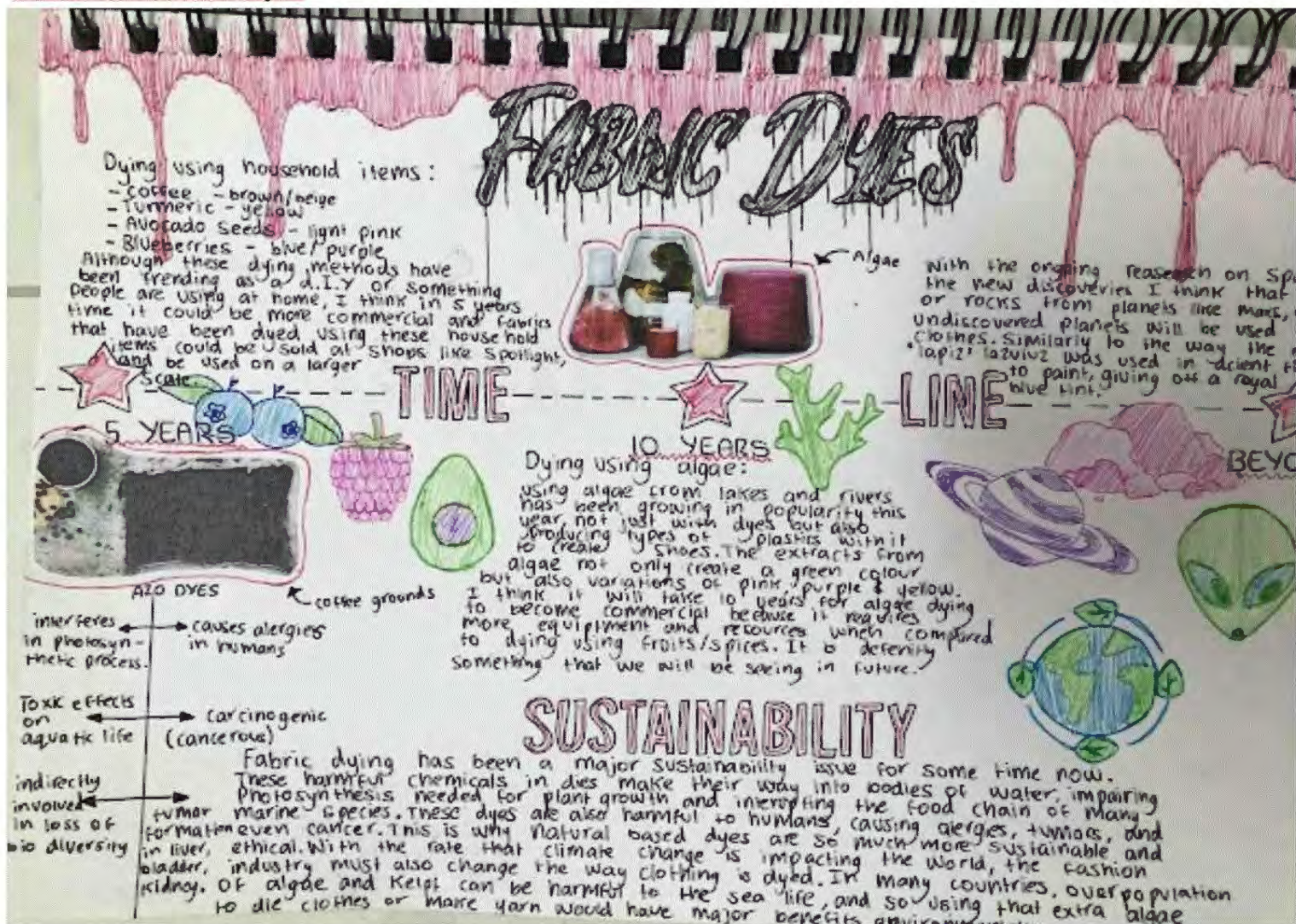
- Resources: Must be organic/eco-friendly, as the client has requested this
- Size: Must be suitable for a baby aged 12-24 months
- Health and Safety: Must be dyed with natural dyes- and therefore meet the health and safety requirements of NZ Childrenswear
- User Friendly: Must be safe to use, wash in the washing machine and be worn by babies

My Specifications

My client has requested the product will:

- Be made from natural fabric - either cotton, merino wool blends, or another soft natural material
- Be dyed naturally in the colour dusty pink using avocado pips and skins
- Be made for [redacted] in the size range of 12-24 months age
- Be washing machine-safe
- Be socially acceptable to use at home and during tummy time/playtime
- Have adjustable sizing - through pop studs to accommodate for sizes 12-24 months
- Have a removable and washable insert for easy care
- Have the correct child health and safety labels

Research on Fabric Dyes



Stakeholder Feedback

'It's so interesting how many colours you can create using household items. I might have to try some of these myself. I did know about the coffee grounds as it's a trend that's been on TikTok recently where people give their jeans an old faded brown look using coffee grounds. Can't wait to see how you use this idea!' - [redacted] (Social Acceptability of ideas)

My Thinking

At this point, I have gained feedback from [redacted] to confirm my ideas would be socially acceptable and therefore acceptable to move forward. I want to create a mood board to develop my thinking further and organise the ideas I have about natural dyes and see who else is doing natural dyeing in New Zealand and how, and other possible ideas as I don't want to refine it just to one thing this early into my project.

IDEAS

My favourite colour!

Other brands that are using algae to create products to reduce carbon footprint. However there are no brands like this in NZ

'Native Shoes'

being created from algae in knitting

Baby pink colour extracted from avocado seeds easy to do at home

These fibres won't be harmful to you and some of the beautiful colours created from natural dyes.

NZ brand 'NUKU' sells naturally dyed women's clothing

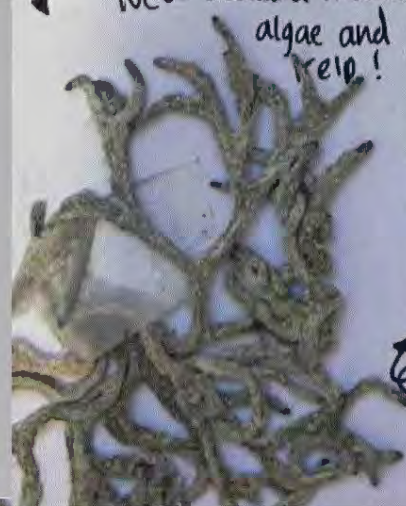
re-uses plants to extract colour.

up-cycling a good way to increase the life cycle of either clothes or single use plastics.

using old garments to make new ones

Nuku from the earth, to the earth

more than enough natural resources in New Zealand including algae and kelp!



Instead of throwing away old t-shirts and contributing to textile waste, these shirts have been up-cycled into a bag that can be used.

Stakeholder Feedback

'It's nice to see where your thinking is at. This brainstorm will evolve over time and you should write down some questions you have/ are thinking about as a designer. Such as - 'How could I merge natural dyes into a useful/ needed product? What could this look like? Is there a 'need' in the world for this? Great start, let's catch up next week to see how you are going with your brief development.' - [REDACTED]

'Even though I like your idea around upcycling I think it has been done a lot recently, especially by teens who upcycle clothes they got from a second-hand store. I think creating natural dyes or using algae in your project would be more original and a fresh idea you haven't looked into. However, also remember to be realistic as we don't have the resources available to be extracting dyes from algae most likely - do some research into it though!' [REDACTED]

My Thinking

From this mood board, my thinking was directed towards a specific target market as the light pink shade I found derived from avocado pips/skins reminded me of baby clothes and childrenswear so I could have that as my target market if I move forward with this idea.

Community Input:

In one of my other subjects, our class was looking into the detrimental environmental impacts of sanitary items and nappies. My teacher pointed out that in the old times mothers would use cloth diapers, washing them and reusing them, as well as using rags for female sanitary products, which were also washed and reused.

My Thinking

From this input, my thinking was led towards making old fashioned cloth diapers with a modern twist so that they would suit today's fashion and not look like they belong in the previous century, ensuring they meet social acceptability. I then discussed this idea with my stakeholders to further guide my thinking.

Stakeholder Feedback

'I think this is an excellent project idea. It definitely ties in with the principles of kaitiakitanga, looking after the environment, you should look into the Sustainable Development Goals for 2024 to further develop this idea into a worldwide need. There has also been a big change in perspective after the lockdowns and through social media of mothers wanting more organic and natural products for their babies, you could research further into this when you do your social considerations. You could still tie in your thinking about natural dyes into this as you could naturally dye the fabric you're going to use or make some patterns with it.' - [REDACTED]

'I really like this idea, you'll definitely have to talk to your grandma about it because she used cloth diapers on me and my brothers when we were babies so you could ask her what modern features would be helpful!' -Mum

'Yes, I used cloth diapers throughout my children's entire infancy although your mum was very smart and she was potty trained quite young I still remember the pain of having freshly changed her diaper and she goes and poos herself straight away, leaving me to repeat the cleaning and changing process all over again!' - Grandma

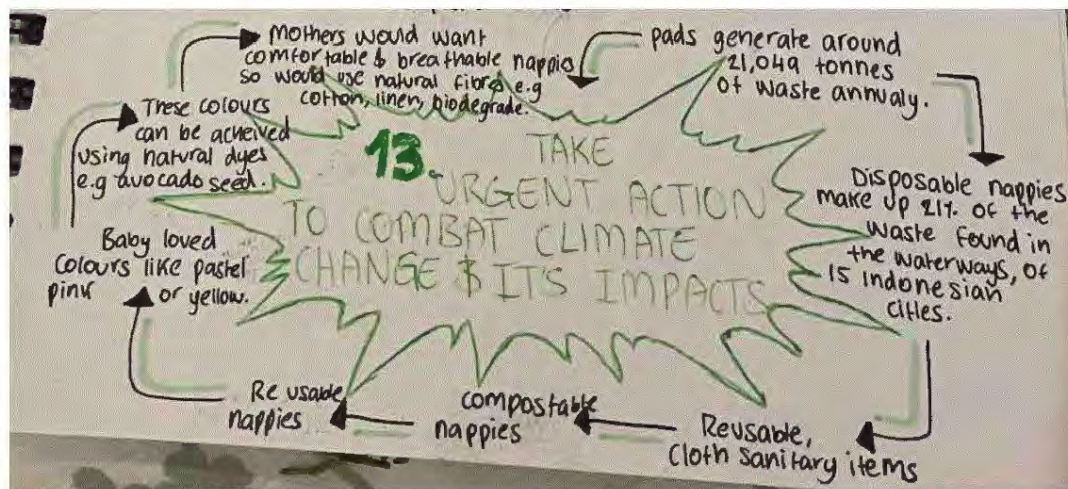
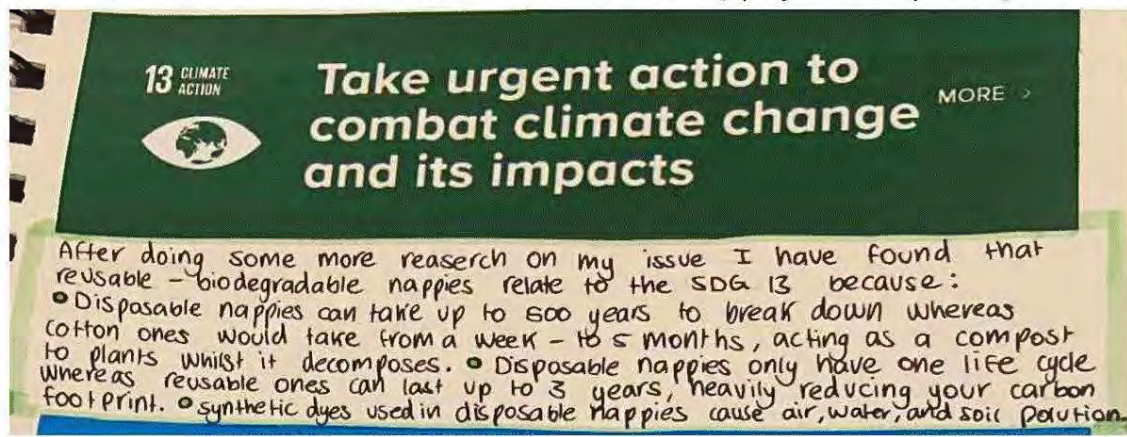
My Thinking

From this stakeholder feedback, my thinking has been informed to look at the Sustainable development goals, and how they could tie into my thinking about reusable nappies and natural dyes.

Sustainable Development Goals (SDG)

During the 'Earth Summit' in 1992, more than 178 countries adopted 'Agenda 21', a plan of action for sustainable development to improve human life whilst protecting the environment. As part of this agenda, the 17 sustainable

development goals were put into place as a guideline of some of the different aspects we should keep in mind when leading the space of change to be on track to achieve some of these goals by 2030. Out of these 17 goals, I've brainstormed and even done a bit of research on how my project could possibly link to some of these goals.



My Thinking

From my research and my brainstorms, I have decided that goal number 13 would be best suited to my project as it allows me to link back to Kaitiakitanga concepts of looking after the earth and to designers of the future, looking into the issues of climate change and its effects, and how I can reduce these through innovative designs.

Stakeholder Feedback

'I think that goal 13 matches your project best and I thought some of those impacts that disposable diapers have on the environment were quite shocking. I didn't think that something used so often and so normalised was so harmful, 500 years to break down is crazy! Can't wait to see what other facts you discover when researching your project in further depth.' - [REDACTED]

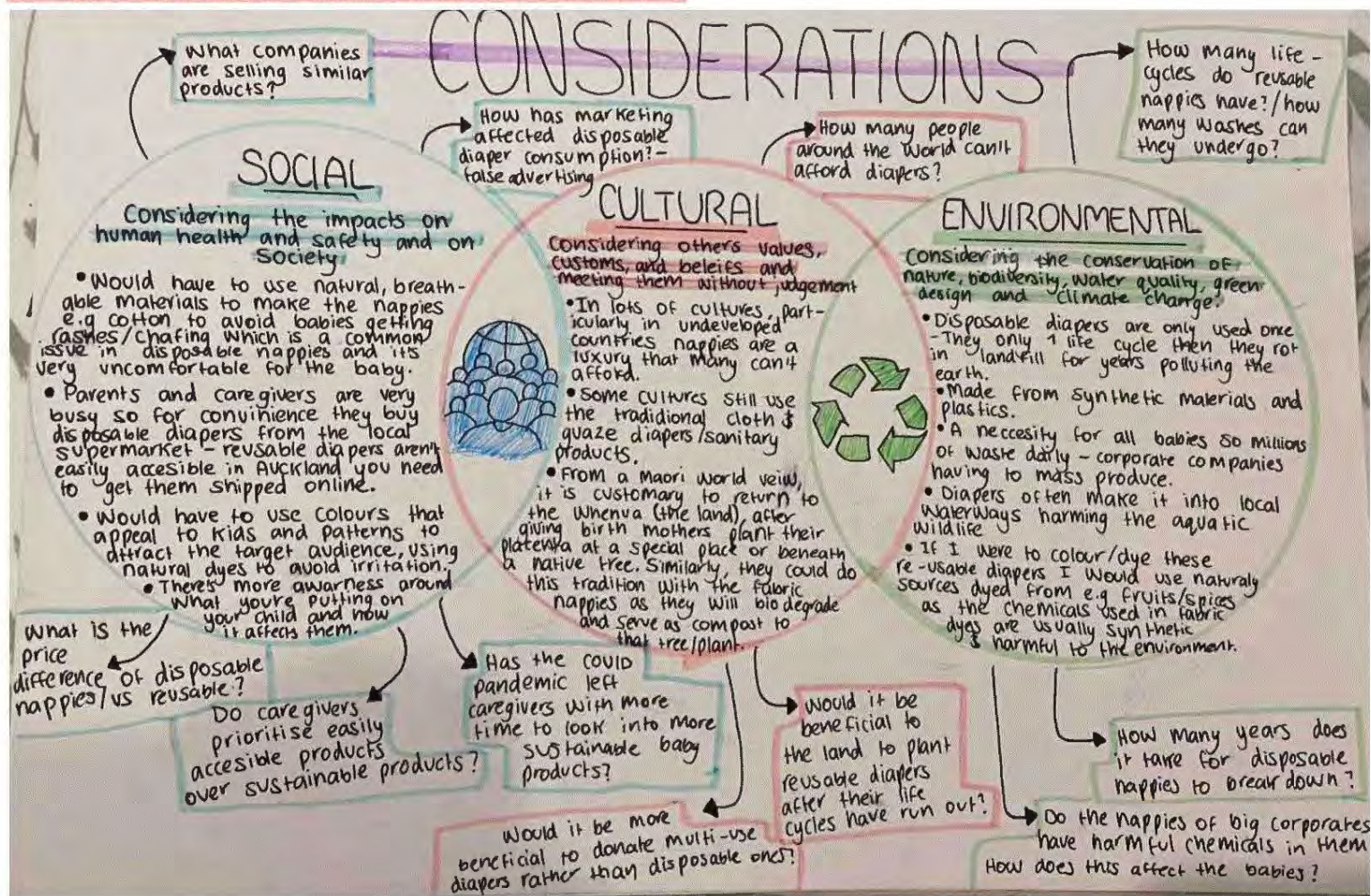
'You will need to work with a client this year and although having a mother and baby willing to be your client may be hard, I have a niece Harper who I could be suitable for your project. I can get you in contact with [REDACTED] and she can be your client.'

'If you do struggle to find a client I have a friend who has a one-year-old son who studied fashion design so she'd be a good client and she'd be willing to help as she's interested in the topic.' - Mum

My Thinking

From a previous conversation with [REDACTED] my thinking was informed to look at some constraints/considerations within my project so that I can develop my project ideas further and refine some concepts.

Context Considerations- Social/ Cultural/ Environmental



Stakeholder Feedback

'These are some good ideas you've put down. You should be critically evaluating each of these considerations and writing some questions around the circles that you can answer after doing some more research in this field.'

'I think It'd be good for you to do a page specifically for your questions about your environmental considerations because It'd be good to link that research into your project and prove with evidence why it is an issue in our world today.'

'You should be critically evaluating each of these considerations and writing some questions around the circles that you can answer after conducting some more research.'

My Thinking

From this feedback, I wrote some questions around my Venn diagram to critically evaluate my ideas. This informed my thinking to research some of these questions and look more into the facts.

Research on Context Considerations

Historical and Social Context

The diaper industry is a billion-dollar industry that has been marketed so well that many people don't give a second thought about the negative sides of it. Disposable diapers make up 12% of all domestic waste sent to landfill sitting there for 500 years until they finally break down. Being used by children from ages 0-4 and going through at least 6 a day per baby the production and consumption of disposable diapers is not something that will be decreasing anytime soon. Apart from the



considerable amount of waste that comes from disposable diapers, the chemicals they contain aren't just harmful to the environment, but to your baby as well. Using toxic chemicals such as sodium polyacrylate, dioxin, dyes, and glyphosate, these diapers can cause rashes and disrupt the formation of your baby's sex hormones; while some of these chemicals are banned in certain countries, this is still an issue in New Zealand today. While convenience for disposable nappies plays a big factor in their consumption of them, I think if as a society we were more educated on the issues that disposable diapers bring about, more parents would be making the switch to reusable ones.

The need for diapers has been around since the beginning of history. Throughout the ages, people have created their own versions of diapers using natural resources such as milkweed leaves, animal skins, packed grass, and moss. Starting in the 19th century with the rise of cheaply manufactured cotton fabrics, cloth diapers began to emerge. In World War 2 the increase of working mothers made the labour-intensive washing and boiling of large nappy squares undesirable, so it was around this time that nappy washing services came about. Since the Industrial Revolution, participation of women in the workforce outside the home has increased in industrialised nations, with particularly large growth seen in the 20th century. The social change of more women working, including working mothers, called for a quicker way to change diapers, not having time to wash every diaper due to the busy schedules and lifestyles that the modern world presents parents with. In 1946, Marion Donovan changed the diaper-making game by creating a waterproof covering for cloth diapers using plastic from a shower curtain; she called her diapers 'boaters'. Adding a paper liner to her design she made it absorbent and disposable. It is because of Donovans' advances that disposable diapers took off in the United States soon after that with CHUX, being the first mass-marketed disposable diaper from Johnson & Johnson. In our world today, disposable diapers are easily accessible at every supermarket with a variety of brands available for you to choose from including - Huggies, Pampers, All Good, Luvs, and Pull-Ups.

Cultural Context

In the majority of non-industrialized cultures, mothers know how to tune into their babies' peeing cycles, and how to keep them clean and dry without diapers. This natural practice is common in Asia, Africa, and parts of South America, and was traditionally practised among the Inuit and some Native North American peoples. For these mothers, knowing when their baby needs to go is second nature for them. Over time, mothers can take note of when the baby usually goes, for example, many babies pee as soon as they awaken, and at regular intervals after nursing. Some common signals of body language that mothers look out for to know when the baby needs to go include fussing, squirming, grunting or vocalising, pausing and

becoming still, waking from sleep, a certain frown, etc, similar to the way mothers can tell when their baby is about to cry/scream by observation they can also recognise the signs to when their baby needs to go. The positive effects of this on our environment would be that the need for disposable diapers would decrease and if as a society we evolved and it became common to look out for signals of your baby needing to go then that would be a huge change environmentally reducing our carbon footprint. The negative effect of this would be that it's not 100%, you aren't going to be able to predict your baby's pee cycle accurately and get it right every time and so this could be messy if it gets on sheets, clothes, furniture, or any other unwanted places.

Social and Environmental Context

In the first decades after the commercialisation of disposable nappies, everyone was thrilled with the convenience of not having to wash or reuse nappies. However, in the late 1980s, when there were growing concerns about the environmental effects of disposable nappies, cloth nappies started to make a comeback. Another issue that arose from the introduction of the nappy was the increase in rashes and allergies, 2010 saw an outrage from parents using disposable nappies reporting burns and rashes. In society more recently, there has been even more bad publicity around disposable nappies for the environment as well as causing health issues for babies, which has increased the popularity of cloth nappies once again. Even if it's just a small portion of families changing to cloth in comparison to using disposables, this has major impacts on the environment as just one child in disposables will generate almost 900 kg of nappy waste during its first two years of infancy. If only 20% of babies in nappies switched to reusables, the amount of waste that could be prevented in Europe alone would be more than 1 million tonnes per year. For every reusable nappy changed, that is one less disposable in landfill, cutting its 500-year lifecycle short.

Over the last century, the average age that our children are being toilet trained has moved from 12-18 months to an average of around 3 or even 4 years today. A survey from ERIC, The Children's Bowel & Bladder Charity showed that parents are toilet training their children later and that more children than ever before are starting school wearing nappies or pull-ups. This is because of the introduction of disposable nappies. Modern nappies are so absorbent children don't know when they are wet and don't recognise when they need to use the toilet. While disposable diapers are very convenient for parents, when it comes to potty training they can make the process harder and take longer. Disposable diapers are designed to draw all the moisture away from a child's bottom to prevent their skin from getting sore and keep them feeling comfortable. This encourages your child to keep using them as they aren't causing any discomfort and it takes much less effort to use them than to have to use the toilet. A child needs to get the feeling of wetness to help them make the connection with what happens when they do a wee to help them with potty training. Changes in parenting style over the last decade have also impacted this. Modern

parenting theories emphasise a child-led approach which can delay toilet training, as families wait too long for their child to take the initiative. A child-led approach worked well when children were wearing washable nappies, but it isn't always as effective with disposables. There isn't the same motivation for children to want to stop wearing them. The societal change of working mothers has meant that more children spend longer in child-care settings, often cared for by early years workers who do not have the skills or experience to support toilet training and so disposable nappies are continuously worn throughout kindergarten. This societal change of children being potty trained later has prolonged the use of nappies which is expensive, time-intensive, and giving into consumerism. Nappies being used to function as a toilet creates bad habits in your toddler and leads to nappy rash issues. These societal changes have immensely impacted the environment because it means extra years of disposable nappy use, which

could've been avoided if children had been potty trained earlier and wouldn't have been reliant on diapers. Around 20 billion pieces of used diapers end up in landfills each year, which generates more than 3.5 million tons of diaper waste. If children were potty trained earlier, as they had been in past decades, this waste would reduce significantly as just one year can cause all that landfill. As a ripple effect, diaper companies are on the high. The market experienced 4% year-on-year growth in 2022 and is estimated to achieve revenue of US\$ 48.65 billion in 2023. Looking ahead, global demand for baby disposable diapers is predicted to increase at a CAGR of 4.2%, thereby reaching a market value of US\$ 73.41 billion by 2033. As the demand for disposable diapers is higher, the supply from diaper companies has increased.

Health Issues

Many toxic chemicals have been found in disposable diapers that can be harmful to baby's skin. Some of these chemicals include:

Sodium polyacrylate - Added to disposable nappies as a powder to improve absorbency all disposable nappies have this. It turns into a gel when wet and often sticks to the baby's genitals (if you have ever noticed gel beads on your baby, this is what it is). This is the same chemical that used to be in tampons but was taken out in 1985 due to causing toxic shock syndrome. This chemical can cause an allergic reaction, severe skin irritation, oozing blood from perineum and scrotal tissues, fever, vomiting, staph infection, and female organ problems.

Dioxin - A chemical by-product from bleaching paper using chlorine gas. Dioxin is the most toxic of all cancer-causing chemicals. It can cause birth defects, skin/liver disease, and genetic damage. Although it is banned in most countries, some believe that the tiny size of dioxin exposure from nappies is nothing to worry about, but every little bit of a carcinogenic adds up.

TributylTin (TBT) - TBT is highly toxic and harms the immune and hormone systems. The Women's Environmental Network says that it shouldn't be in any household product, let alone something worn next to delicate skin. It is known to disrupt sex hormones even in small concentrations and is speculated to cause sterility in boys.

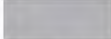
Phthalates - These are plastic softeners and are also hormone disruptors by mimicking human hormones and sending false signals. Phthalates were recently banned in children's teething rings and other toys due to toxicity because children are so vulnerable to exposure due to floor play, hand-to-mouth behaviour and their developing nervous and reproductive systems. However, they are still in disposable nappies – right up against their reproductive organs.

Dyes - The dyes in disposable nappies often contain heavy metals. These dyes cause allergic reactions resulting in rashes and repeated exposure can cause long-term allergy. Additionally, damage to the central nervous system, kidneys, and liver can be caused by dyes found in some disposable nappies.

Glyphosate - Also known as [REDACTED] and from a [REDACTED] cancer claims from [REDACTED]

These chemicals are just the ones that companies are legally forced to show in the composition packaging. Many other potential chemicals may be included that disposable nappy companies don't have to tell you about. There is no law demanding them to have all their ingredients on the side of the package like shampoo or other items of clothing.



In New Zealand,  is the most popular disposable diaper brand. Their ingredients list is available on the packaging, listed by order of predominance, meaning that the largest concentration of an ingredient is listed at the top and it moves down by amount. It says that it contains: wood pulp, sodium polyacrylate, polypropylene, polyethylene, adhesives, polyester, polyurethane elastics, polyolefin elastic, colour-changing wetness indicator, Colourants, printing inks. Some of these chemicals like sodium polyacrylate and the inks/dyes have major health risks as discussed above, and the main component of these diapers - wood pulp, its production has very bad effects on our environment. Forest impacts associated with unsustainable pulpwood production can negatively impact climate, such as in Sumatra, where carbon is released from deep peatlands that are converted to pulp plantations. In addition, pulp and paper manufacturing is among the world's most water and energy-intensive industries. The largest share of greenhouse gases released in pulp and paper manufacturing comes from the energy production to power the mills. Wood pulp mills may also discharge many pollutants into surrounding water bodies, which causes damage to aquatic ecosystems and threatens the health of people who live near the mill.

Research on the content of toxic compounds in diapers has been done in only a few countries, therefore, it is not known what the situation is in other countries. As a society, we haven't been adequately informed on the effects of these chemicals due to the lack of conclusive research and information provided. At present, in most countries, there are no legal regulations that would define the maximum allowed concentration of individual chemical substances in diapers. Hence, there are also no universal methods of determining them, and only a few publications can be found on this subject. This lack of information is how big disposable diaper companies are getting away with these harsh and harmful chemicals and production methods.

Social Context

The major trend in the baby diaper industry revolves around sustainability and eco-friendliness. Manufacturers are increasingly focusing on producing diapers using biodegradable materials, reducing environmental impact, and enhancing recyclability. While they have strategically marketed their diapers to be 'green' they're not actually much better for the environment, and putting a sustainability label on their product allows them to justify their increases in price, turning sustainability into a money grab. Many companies market their products as, "green", "plant-based" or "eco-friendly," but upon closer inspection, their diapers are not much better for the environment than conventional plastic disposable diapers. Some companies use vague or misleading language such as plant-based on their packaging or website. All plant-based means is that a small portion of the product may utilise ingredients from plants, but it does not necessarily mean the product is made fully from plant-based materials. Other companies may use eco-friendly materials for parts of their diapers but use plastic or other harmful chemicals in the remainder, making the overall product less environmentally friendly than it may appear. This is commonly known as 'greenwashing'. Greenwashing is an unethical marketing strategy where companies mislead their customers by claiming to be environmentally sustainable and friendly because 73% of global consumers would change their consumption habits to reduce their environmental impact, so big companies are using this to their advantage. Social media has played a major part in this 'greenwashing' trend being the main platform to advertise their products. In a study commissioned by Greenpeace, they looked at more than 2,000 posts from 375 accounts across a wide variety of different social media platforms. They included 12 of the biggest car



brands, five of the biggest airlines, and five of the largest fossil fuel companies. Their results showed that only one in five “green” car adverts analysed actually sold a product - the rest served to present a brand as green. The same thing happens within the diaper industry, social media is an excellent way to market a product, and if you see a post with greenwashing terms that you don’t know the true meaning of - or how much of the product has to be sustainable to give it that label it’s easy to buy into that propaganda, believing you’re making a difference.

Cultural Context

Due to the fast-paced competitive industry of disposable diapers, big companies want to accelerate the expansion of their products into new frontiers, eager to beat their competitors. Corporations such as [REDACTED]



[REDACTED] want to be first in line to sell their products to new “throw-away customers” in countries of the Middle East, Africa, and Asia. These companies commenced their operations by changing the traditional views and practices of these cultures, educating them on how to use disposable diapers and why they should invest in them. Little did these communities know that this product would have detrimental impacts on their waterways. There are many towns, cities, and densely populated rural areas in Africa, where little, or no waste removal services are delivered. Used baby diapers are discarded along roadsides and bridges, where this waste often ends up directly in streams and rivers. This new pollution combined with impacts from

mining, excessive soil erosion, and increased land transformation is pushing southern Africa’s rivers to the limits of sustainability. Easily accessible areas along local rivers are used for traditional ceremonies and rituals. However, the sacredness of these rituals is suffering due to the ceremonial areas being littered with discarded diapers, rendering the space unfit for healing or religious practices. Apart from the obvious plastic pollution, used diapers contain human excrement, which should never be disposed of irresponsibly as it might lead to dangerous disease epidemics. Undeveloped countries such as Africa are at the highest risk if an epidemic were to break out, lacking the medical resources necessary, many would die. According to the World Health Organisation, used diapers should first be rinsed before being discarded, to ensure raw human waste does not get disposed of in landfills. However, not many people are aware of this and so they dispose of their diapers irresponsibly. Industry manufacturers, distributors, and retailers should be held accountable for this problem as they are the ones changing the culture of diapers in undeveloped countries and promoting the use of disposable diapers, even if these countries don’t have sufficient waste removal services in place and they end up irresponsibly disposed of. The industry has to be proactively involved in finding solutions to the problems they created, assisting in developing disposal facilities where none currently exist, and developing their products to be recyclable, reusable, or safely compostable.

Other Brands

All the New Zealand companies offering nappies are small businesses that all claim to have an eco or sustainable aspect about them, differentiating them from the big corporate brands available at local supermarkets. Some of these companies include [REDACTED] for disposable nappies - with claims to be biodegradable, and [REDACTED] for reusable cloth diapers. All these brands are strictly online, so they don’t have a set-up store, however, some big chains like Countdown may stock them in-store.

[REDACTED] nappies have the certification of FSC. The Forest Stewardship Council (FSC) is an international, non-governmental organisation dedicated to promoting responsible management of the world’s forests. Since its foundation in 1994, FSC has grown to become the world’s most respected and widespread forest certification system. FSC’s pioneering certification system enables businesses and consumers to choose wood, paper, and other

forest products made with materials that support responsible forestry. Forest management certification confirms that the forest is being managed in a way that preserves biological diversity and benefits the lives of local people and workers while ensuring it sustains economic viability. FSC-certified forests are managed to strict environmental, social, and economic standards.

premium nappies are curated using STANDARD-100 by OEKO-TEX® certified fabrics, which means that you can be certain every component has been tested for harmful substances. The test takes into consideration numerous regulated and

non-regulated substances, and in many cases goes beyond national and international requirements (OEKO-TEX®, 2021). While they say that their premium nappy range has this certification, they don't say that their other collections e.g the Core nappies collection have this certification, so they could very well be made with some harmful chemicals as they are lacking this certification. Their diaper liners without going any further are a bright white, meaning they would've bleached them from the original natural bamboo colour and bleach is a harmful chemical. They also say that their

manufacturing factory focuses on more than just the ethical treatment and fair pay of its workers by being SMETA audited. SMETA (Sedex

Members Ethical Trade Audit) is the most widely used format for social audits in the world, enabling businesses to assess their sites and suppliers to understand working conditions in their supply chain. is regularly audited to help improve gender equality, detection, and remediation of forced labour, and visible worker representation, and are working towards increased sustainable livelihoods.

nappy shells are, made from 100% post-consumer recycled plastic bottles (GRS-certified fabrics), which helps reduce manufacturing energy by 75% and water consumption by 90% (when compared to virgin polyester fabric) each nappy saves approximately six plastic bottles from our oceans and landfill. The GRS certificate only applies to fabrics that contain more than 50% recycled fibres, this means that nappies don't necessarily have to be made from 100% recycled plastic bottles, as they claim, in order to receive this certification.

Where to next

Considering the health problems of babies due to the chemicals in disposable diapers, the environmental impact diapers have on our world today, the cultures being exploited in the production, and the societal issue of greenwashing, from my research above it can be concluded that there is an issue surrounding the disposable diaper market. Being a Kaitiaki, I am called to create solutions to be a guardian of Aotearoa's natural environment. There is a need for my outcome to be developed - a reusable, compostable, diaper made from natural fabrics that doesn't contain synthetic dyes or bleaches in New Zealand.



The Diaper Dilemma

The Facts

- It can take up to **500** years for a disposable nappy to completely decompose during which time it can produce the greenhouse gas methane and the toxic liquid leachate that can pollute the soil and local water supplies.
- It takes over **1,500** litres of crude oil to produce enough nappies for one child (from birth to 2.5 years).
- It takes **10** times more water to produce disposable nappies than the water used to wash reusable ones.
- Wood pulp is a main component of disposable diapers, and the production of it is both highly water intensive and can be a source of deforestation and soil impoverishment.

Pros

- **CONVENIENCE**: changing & disposing is easy and convenient.
- **DRYNESS**: They are more absorbent & keep babies drier for longer.
- **VARIETY**: There are a lot of options including different sizes.

Cons

- **ENVIRONMENTAL**: lots of waste & chemicals in our waterways.
- **HEALTH CONSEQUENCE**: can cause irritation, allergies & other issues in your baby, due to the chemicals in it.

Chemicals

There are many harmful chemicals found in disposable diapers that can be harmful to your babies skin, some of these include...

- ⚠️ **SODIUM POLYACRYLATE** - Added as a powder to improve absorbency this can cause allergic reactions, severe skin irritation, oozing blood from scrotal tissues, fever, vomiting, staph infection & female organ problems.
- ⚠️ **DIOXIN** - Chemical by-product from bleaching paper using chlorine gas. Dioxin is the most toxic of all cancer-causing chemicals. It can cause birth defects, skin/liver disease, genetic damage and it's banned in most countries.
- ⚠️ **TRIBUTYL TIN (TBT)** - Highly toxic & harms the immune & hormone systems. It's known to disrupt sex hormones & cause sterility in boys.
- ⚠️ **PHTHALATES** - These are plastic softeners and are also hormone disruptors by mimicking human hormones and sending false signals.
- ⚠️ **DYES** - The dyes in disposable nappies often contain heavy metals. These dyes cause allergic reaction resulting in rashes, additionally damage to the central nervous system, kidneys and liver can be caused by dyes found in some disposable diapers.
- ⚠️ **GLYPHOSATE** - Also known as Roundup and from a company which is currently dealing with multiple lawsuits over cancer claims from Roundup.

In New Zealand

- On average, a baby uses 7 nappies a day.
- 10% of the total waste in landfill is from nappies
- 394,965,000 litres of littered disposable nappies were found over a 6 month period.
- In 2024, the baby Diapers market in NZ generated a revenue of \$67.63m
- Around 600 million disposable nappies are used every year.

Need

Through my research on disposable nappies and the impacts they have both on the environment and on the health of babies, I have established a need for re-usable cloth diapers.

Stakeholder Feedback

'I chose to use cloth diapers for your mum and your uncles without even knowing about some of these impacts, I think this is a social problem that people tend to ignore the facts and the detrimental environmental, and health effects when it's convenient for them. I agree with being potty trained later too, your mother learned much quicker than the age your younger cousins learned too and that's only a 40-year difference, I can imagine how this could escalate if we continue down this path children won't be potty trained till they're 7!' - Grandma

'It'd be interesting to see which brands contain what chemicals because I wasn't aware of all the health concerns around these chemicals and that it's legal to use these chemicals in diapers.' - Mum

My Thinking

This feedback made me consider other well-known and loved brands of diapers, what sort of chemicals they are using or what 'greenwashing' techniques are they using to try and claim their products as 'green'. This led my thinking to do some market research into other brands in New Zealand both disposable, and reusable by conducting a GAPS and SWOT analysis.

GAPS and SWOTS Analysis

I am going to split my market research into 3 different sections, disposable diapers, biodegradable diapers, and reusable diapers.

DISPOSABLE

Product Brand	Materials	Claims	Where it's made
	Wood Pulp, Sodium Polyacrylate, Polypropylene, Polyethylene, Adhesives, Polyester, Polyurethane elastics, Polyolefin Elastic, Color-changing wetness indicators, Colorants, Printing Inks	Their diapers have no added formaldehyde, elemental chlorine, natural rubber latex, or other chemicals restricted by [REDACTED] Huggies also has a 'tiniest footprint' label. Within this label, they have claimed that their diapers are responsibly sourced. This means that the wood fibre used in [REDACTED] [REDACTED] is certified to internationally recognised forest certification standards and is responsibly sourced. [REDACTED] are made with an average of 30% biodegradable material (does not include Nappy-Pants) [REDACTED] feature a plant-derived liner wrap sourced from renewable sugarcane.	The American manufacturing company, [REDACTED] their products are made in the USA

Pros	Cons
- Easily accessible from local providers such as Countdown, New World, Pak n Save and Chemist Warehouse -Tailor-made for girls with lower down absorbency as needed, and pink Minnie Mouse design - appealing to little girls -QR code on packaging with a range of activities for toddlers -Low prices -List of banned/restricted items and chemicals in their diapers on the Huggies website	-Doesn't provide an ingredients list on packaging, and isn't available anywhere online -Uses chemicals like sodium polyacrylate which can cause allergic reactions, severe skin irritation, bleeding from scrotal tissues, fevers, vomiting, staph infections, and female organ problems. -Takes 500 years to biodegrade -Uses soft plastic as its packaging -Uses artificial dyes for their design printings -Uses very vague labels like 'no added nasties' with no certifications or guarantees - possibly greenwashing

Product Brand	Materials	Claims	Where it's made
	The ingredients/material used for Pampers diapers aren't included on the packaging, nor are they available online	On the packaging these diapers have claims like: easy change for active kids, ultra soft for delicate skin, wetness indicator, and dry-to-touch premium absorbency On their website you can see they have chosen to work with Sedex, a membership organisation that provides one of the world's leading online platforms for companies to manage and improve working conditions in global supply chains. Sedex provides practical tools, services, and a community network to help companies improve their responsible and sustainable business practices, and source responsibly.	 doesn't say where their diapers are made from specifically but they do have this statement on their website regarding their supply chain: 'As Kiwis ourselves, we strive to use New Zealand manufacturers for our products as much as possible - but sometimes we do have to source products and ingredients from overseas.'

Pros	Cons
-Cheap prices without compromising quality -Premium absorbency and ultra soft (as claimed) -Use Sedex standards to ensure their manufacturers are working fair hours and are getting paid -Easily accessible at your local supermarket (Pak n Save, New World, Four Square)	-No ingredients list on the packaging or found anywhere online -Could be harmful chemical in the materials or production of these diapers, extra suspicious of this occurring due to the lack of ingredients and materials list -Uni-sex not tailored specifically for boys or girls, may result in absorbency in unrequired places, or not enough absorbency in others - compromising

Product Brand	Materials	Claims	Where it's made
	Their premium diapers and training pants are predominantly made of fluff pulp, super absorbent material (SAP), polypropylene non-woven fabrics, and polyethylene film, together with some fastening and elastic materials. They use feather-soft materials, and water-based inks and are dermatologically certified to be safe and ultra-gentle on sensitive skin. Although they do undergo bleaching, ECF pulp undergoes a very safe bleaching process with chlorine dioxide, where chlorine is not 'added' to the diaper at any stage	 have a claim that says these nappies will stay up to 12 hours dry due to their 3D Core Technology.  are dermatologically certified, and use no lotions, no latex, and no fragrances. All Rascal + Friends products are proudly certified Vegan and Cruelty-Free by PETA. They stand firmly against testing on animals and are proud to offer cruelty-free products. They do not use materials from suppliers that test on animals. Rascal + Friends is also BioChecked Non-Glyphosate Certified, Dermatest Guaranteed, and OEKO-TEX Standard 100 Certified.	They source premium raw materials from around the world and assemble their products in China.

Pros	Cons
- Has all its ingredients easily accessible on its website -Don't use any harsh chemicals -Have multiple trustworthy well-used certifications to back its claims -Their packaging is fully recyclable -They use water-based dyes and inks -Easily accessible at your local supermarket (Pak n Save, New World, Four Square)	-Only have unisex models - their features may not be meeting the specific needs of boys compared to girls and having to compromise -Misleading claim saying it's designed and developed in New Zealand because their raw materials are sourced from around the world and their diapers are made in China -No claim around fair trade or fair working conditions - cheap but at what cost? - since they are made in China and China is known for having a large number of sweatshops/factories

BIODEGRADABLE

Product Brand	Materials	Claims	Where it's made
	Their diapers are made of bamboo, corn starch, wood pulp, sugar cane, rice and chamomile flower extract. Their personal care line for babies and their parents is free of parabens, phthalates, mineral oils, PABA and DEA which helps to avoid allergies and toxins.	Their certifications prove that their diapers have been dermatologically tested, the dermatest seal of approval is a mark of distinction for independently tested products which come into contact with the skin. Their FSC Mix Label means the product is made with a mixture of materials from FSC-certified forests, recycled materials, and/or FSC-controlled wood.	For their diapers it says they use 100% USA natural wood pulp and High-quality ultra-fast absorbent Japanese SAP (Super Absorbent Polymer) and that the rest is presumably sourced in New Zealand

Pros	Cons
-Easily accessible ingredients list + justifications as to why each ingredient is used -Uses all natural ingredients -Up to 12 hours absorbency -Compostable packaging + says what the packaging is made of to prove its biodegradable -Biodegradable nappies only take 2-3 years to break down	-Diapers are a pure white colour - possibly bleached in order to have reached this colour - Can't see where they make these diapers or where the factories are located - Statements on their website make it seem like they are made in New Zealand, but contradict themselves by saying they use US wood pulp and Japanese polymer.

Product Brand	Materials	Claims	Where it's made
	They have a biodegradable cellulose based outer cover (rayon), and inside for absorbency they have non-chlorine bleached fluff (paper) pulp from SFC certified farmed trees and a super absorbent polymer (SAP). They do not contain any oil-based plastic, no chlorine, no bleach, no heavy metals, no phthalates	has the FSC mix certification which means the product is made with a mixture of materials from FSC-certified forests, recycled materials, and/or FSC-controlled wood. They claim that their nappies will compost at the same rate as other organic matter i.e. in one compost cycle at commercial compost facilities.	The information on where the diapers are made is nowhere to be found on the website

	and no potentially irritating perfume.		
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Pros	Cons
-Biodegradable in home compost can be decomposed within 5 days (allegedly) -FSC certified -Says what it's made from - its ingredients -Made from natural materials/ingredients	-Packaging is very simple and boring -Doesn't have a transparent supply chain - or any supply chain -Ordered a month ago and still hasn't arrived - have tried to contact them multiple times and no reply -They have awful reviews online although they try to hide this on the website - from customers who also haven't received their order and can't get into contact with them -No stockists - can only buy them online

Product Brand	Materials	Claims	Where it's made
	made from 100% Bamboo Fibre, Fluff Pulp (Chlorine-Free Pine Cellulose), Sumitomo SAP (Super Absorbent Polymer), Elastic Waistband & Cuffs, Velcro Tabs. Made from eco-friendly, sustainable sourced bamboo fibre, they contain no nasty chemicals used in the manufacturing process, they are free of chlorine, alcohol, perfumes and preservatives, latex, PVC, TBT, antioxidants, phthalates and fluorescence. Bamboo is 100% biodegradable.	 biodegradable nappies & pants are 100% plant-based, sustainably harvested and free of nasties. They are 85% biodegradable within 2 years, and independent testing has shown that they will break down much faster than traditional disposable nappies. After use,  nappies will break down by 61% within the first 75 days – so even if you just throw them in the bin they will already be on their way and starting to degrade by the time they get to landfill. Their diapers are FSC approved which shows that it comes from responsibly managed forests	Their fluff pulp comes from Finland and their diapers are manufactured in China

Pros	Cons
-85% biodegradable within 2 years, the only part that isn't biodegradable is the waistband -Will still biodegrade in landfill - will just take longer to decompose -Is FSC, FDA and CE certified -Made from natural materials - doesn't use chlorine to bleach them -Free of chlorine, alcohol, perfumes and preservatives, latex, PVC, TBT, antioxidants, phthalates and fluorescence. -Compostable packaging	-Website is misleading - makes it seem like it's a New Zealand company when in reality they are just the New Zealand suppliers for the brand  -Doesn't have a transparent supply chain - can't see where their materials come from

REUSABLE

Product Brand	Materials	Claims	Where it's made
	They are made using waterproof PUL with a suede cloth lining. Each nappy comes with one four-layer microfiber insert which goes inside the pocket for absorbency. They have a	They claim to be saving parents money as a disposable nappy averages about 45c and their nappies should last right through until your little one is toilet trained, and possibly for future children too, so within 3 months you'll be saving yourself money	They design the nappies here in New Zealand alongside their suppliers, selecting the fabrics, layout,

	suede lining to wick away moisture from the skin. Coming with both bamboo and hemp means they are more absorbent than a standard OSFM (which comes with a microfibre).	They have won numerous awards for their products including Finalists - EY Entrepreneur of The Year 2023 New Zealand, Oh Baby Magazine Best Cloth Nappy Brand Gold Award Winner, Best Eco-friendly Product Silver Award Winner 2022	and domes that they want to stock. However, their nappies are made in China
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Pros	Cons
-Transparent supply chain - actually provides this information on their website -Pop studs to adjust waist sizing - you can make it fit better for your baby -You only need to buy a few and you can reuse them - saving money -More environmentally friendly - can be reused many times before being disposed off where the inserts will biodegrade	-The outer shell is possibly made from plastic (they didn't specify the material on the website) -Doesn't say anything about the packaging - is it compostable? Eco Friendly? -Not convenient to buy - have to buy online or at a stocker in Helensville -Have to wash inserts after every use

Product Brand	Materials	Claims	Where it's made
	The outside shell is made from PUL, made from 100% post-consumer recycled plastic bottles - each nappy saves approximately six plastic bottles from our oceans and landfill. The gauze insert that came with the premium nappy I ordered was composed of 80% viscose from bamboo and 20% polyester. The pad insert that also came with this diaper has a composition of 70% viscose from bamboo and 30% cotton	 premium products use STANDARD-100 by OEKO-TEX® fabrics.STANDARD-100 by OEKO-TEX® is a label for textiles tested for harmful substances. Their manufacturing company is SMETA audited to ensure they are upholding ethical and sustainable working conditions. This includes ensuring workers have representation, sustainable livelihoods, and gender equality - beyond many of the standard requirements of things like fair pay and prevention of forced labour.	Their manufacturing factory focuses on more than just the ethical treatment and fair pay of its workers by being SMETA audited, however, they do not say where their diapers are made.

Pros	Cons
-Lots of certification to back up their claims on sustainability -Their outer shell is made from recycled plastic bottles - increasing sustainability -Their nappies are made from either recycled materials, or natural materials -Can be recycled at the end of it life through kekoas recycle programme in order to make a continious life cycle -Pop studs to adjust to a size that best fits your baby	-Only available for online purchases -Not sure what process was used for the designs - chemical dyes? -Pad and gauze inserts appeared to be bleached -Doesn't say where their diapers are made -Hard/confusing to put on - should come with a tutorial/guide explaining all the features and how customers can maximise these features

Product Brand	Materials	Claims	Where it's made
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	On the product description, it says that [REDACTED] cloth diapers are made of: Outer Shell - PUL waterproof material, Lining - Athletic jersey mesh material, Day Insert - 5 layers; 70% bamboo, 30% cotton, Hourglass Insert - 6 layers; 70% bamboo, 30% cotton	You can choose to use them as pocket-style nappies (stuff the inserts in the pocket), or as an all-in-2 nappy (snap the inserts on the outside lining) Without inserts, you can use the shell as a swim nappy. PUL (water-resistant) tummy panel and PUL inner wings stop moisture from getting onto baby's clothes, especially if they are tummy or side-sleepers. They only use suppliers with STANDARD 100 by OEKO-TEX® certification.	Every product and print is designed in New Zealand and made ethically in China and Pakistan, ensuring fair labour practices which include a fair wage, a safe work environment, and controlled work hours.
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Pros	Cons
-Can be reused and rewashed as many times as desired - Eco-conscious and economical -They have pop studs to adjust the waist and length to best suit your child - don't need to buy bigger sizes as they grow -Cute patterns and designs	-No certifications around fair trade - claim to be ethically made in China and Pakistan but no evidence to back up this claim -Not made from natural fabrics - only the inserts are -Long life cycle in landfill for polyester

Stakeholder Feedback

'I believe there is a strong need for a product that doesn't have harsh chemicals and dyes for children's diapers. It would be interesting to see the different colours you can achieve with natural dyes. I do think that there is a need for a diaper with a transparent supply chain. It would be important to consider how much of a supply chain you can make transparent. Who else in the children's wear industry has a transparent supply chain? I believe there is a need for a redesign of a diaper that is less chemical and more eco-friendly and possibly biodegradable, however, this does not have to be made from entirely natural materials. A waterproof outer shell might be something you trial and test if it could be possible with natural dyes/ and if it could be without harmful chemicals.' - [REDACTED]

'There are so many brand options now than when I used to use cloth diapers. Everything is so much easier in this new technological world we live in we can simply order things online and get them shipped straight home. I remember I'd have to drive to France to get my cloth diapers as there weren't any good options available in Spain at the time. I definitely think that parents have gotten lazy now and they simply buy what's on the shelves at the supermarket, taking for granted all the magnificent options they have with the easy accessibility of the internet.' - Grandma

'I agree that there is a gap in the market and that there is a need for cloth diapers made entirely out of natural materials and that are naturally dyed, with a transparent supply chain. I don't think you need a waterproof outer shell like some of the brands above have because that might take away the made fully from the natural materials gap you are answering to, as I don't think there are natural waterproof materials. You might not even need a waterproof outer anyways depending on your physical environment considerations. You should definitely add this gap analysis to your need page to help you justify your need based on this gap in the market.' - [REDACTED]

My Thinking

From my market research analysis, and my stakeholder feedback, I have concluded that there is a gap in the market and that there is a need for a reusable cloth diaper that is naturally dyed, made fully from natural, compostable fabrics, and has a transparent supply chain.

Stakeholder Feedback

'You should regard the difficulties involved in changing a diaper and some possible features that could be added to your design to make it more parent-friendly and appealing. It'd be a good idea to talk to [REDACTED] about some of the struggles she faced when changing Harper's diapers, as well as get [REDACTED] opinion on this too as he changes her diaper as well. You need to apply your product to a social/community context and ask multiple stakeholders for their opinions and ideas about improving diapers in general through the form of a questionnaire or survey. These stakeholders should include all caregivers both mothers and fathers. If it helps you, make a brainstorm to help get your thinking going on what questions you need to ask these stakeholders' - [REDACTED]

My Thinking

From this feedback, my thinking was informed to create a brainstorm around colours, transformation, size, fabric and sustainability to narrow down some questions I could ask my clients when I come to do the survey Mrs Hickey suggested.

Outer shell, separate to the removable and washable inserts, you don't wash the outer.

Two separate inserts meeting at the half way point



Colour

Considering my diaper is going to be made for girls aged 1-2, I think bright colours suit to this age groups preferences. Possibly pinks, purples or yellows. I wouldn't want to make these diapers too pigmented however, as then the diaper will be seen through the clothing worn overtop, which may not be appealing to some parents. I think some tie die patterns could look good, or even using blocks and stencils to create patterned fabric for these diapers. All my diapers will be dyed naturally using fruits, vegetables, and spices, although this limits my colour palette, I can still create the colours mentioned above using natural dyes.

Transformation

At the moment, I am thinking of having two separate inserts to attach to the inner of the diaper shell with either pop studs or velcro. These two sections could also fold and be attached with pop studs or maybe a zip when changing the diaper to allow for a clean removal and leak free storage for the excrement before it is washed.

Fabric

The insert fabric, having to be more absorbent than the outer shell of the diaper, is typically made from gauze fabric made from cotton as cotton is a very absorbent material. These inserts can also be made from bamboo, another natural fibre. The outer, could also be made from cotton, but not from gauze as the outer shell doesn't need to function as an absorbent the same way the inner insert does. This outer fabric will be the one that gets dyed, not the inner

Sizes

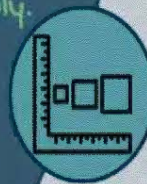
I am focusing on diapers for girls aged 1-2 or 10-15kg and so I will base my sizing off the standard sizing for 10-15kg girls. Because of my pop stud adaptation, the waist will be adjustable and will have a range of sizes to match the babies size. For my washable inserts, I could have different thicknesses of these depending on if the diaper is being used overnight or during the day to ensure there's an appropriate amount of absorption taking place and no unwanted leaks.

Sustainability

The sustainability aspect of my project is going to be the reusable advantages of my design. After an insert has been dirtied and the nappy needs a change, these inserts can then be washed, either by hand or washing machine, and reused, the outer shell is also reused and shouldn't need to be washed as the outer doesn't get dirty. Even if these diapers don't fully replace disposable ones, which for most mothers they won't out of the conveniences of disposables in physical environments like kindergarten, this reduction makes a huge difference.

Pop studs on the front, and around the back in order

to adjust the waist size to have multiple sizes interchangeably.



Pop studs to clip together to wrap up the excrement when changing the diaper, and pop studs or velcro on the underside attaching this thicker gauze to the nappy shell.



Stakeholder Feedback

'If you need me to, once you've planned what you're going to ask the wider stakeholders - parents group, I can send out your questions to my WhatsApp groups because all my friends are mums and so they'll be able to give you a range of answers for your survey.' - Mum

My Thinking

This brainstorm has been helpful to get some ideas flowing for possible questions I could ask my stakeholders. This brain storm has informed my thinking to draft and send out some questions to my stakeholders, each different circle/ring getting a different set of questions based on their relevance to my project.

Survey Responses

[Redacted]

[Redacted]

Sat, 27 Apr, 17:04 ☆ ↩ ⋮

Hi there, [Redacted] For our materials technology curriculum this year, we are looking into 'designers of the future', focusing on the sustainability of everyday products, I came across the negative effects of disposable diapers on our environment. I am researching the environmental, health, social, and economic benefits of old-fashioned reusable cloth diapers as opposed to disposable ones. It would be greatly appreciated if you could answer some of my questions down below and give your expert advice to help me conduct my research.

- 1) Is there any funding for new mothers?
- 2) Is there funding for diapers for new mothers?
- 3) What brand/type of diapers are provided to new mothers if any?
- 4) Does [Redacted] support sustainable providers?
- 5) If not, what's holding you back?

Thanks,

[Redacted]

[Redacted]

Sat, 27 Apr, 17:11 ☆ ↩ ⋮

Hi there, [Redacted] For our materials technology curriculum this year, we are looking into 'designers of the future', focusing on the sustainability of everyday products, I came across the negative effects of disposable diapers on our environment. I am researching the environmental, health, social, and economic benefits of old-fashioned reusable cloth diapers as opposed to disposable ones. It would be greatly appreciated if you could answer some of my questions down below to help me conduct my research with your expert opinion.

- 1) Do you see a lot of issues surrounding nappy rashes during your checkups?
- 2) Are there any specific brands/types of diapers you would recommend to avoid nappy rash?
- 3) Do you think natural cloth diapers would reduce the chances of nappy rashes and infections?

Thanks,

[Redacted]

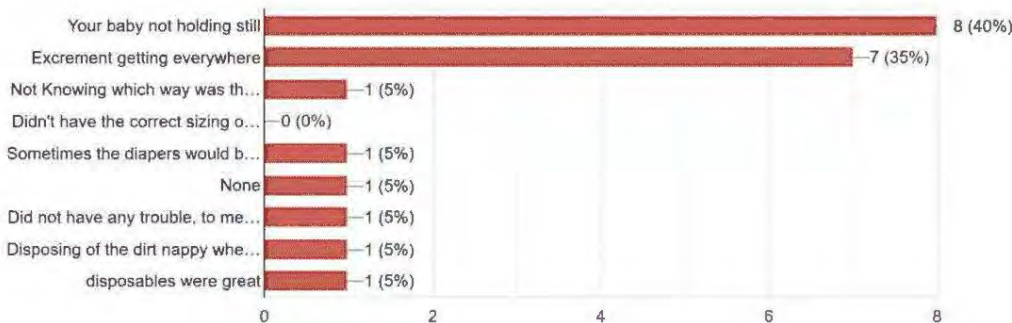
While [Redacted] were an important part of my wider stakeholders, and their expert opinions would've helped my project, they unfortunately didn't get back to me on these questions.

Parents

I got 20 responses from a wide range of parents, and their answers will help me decide what to consider and test in my concept development stage

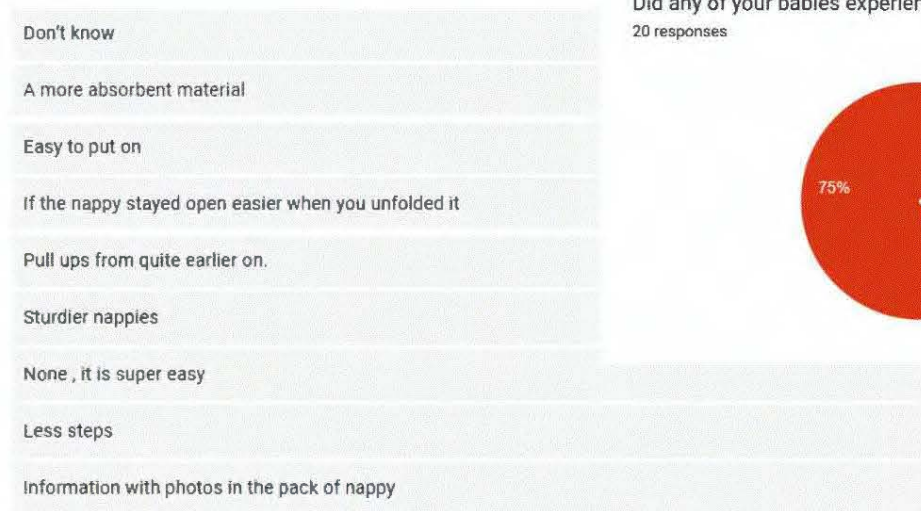
What did you consider the trickiest part about changing your baby's diapers?

20 responses



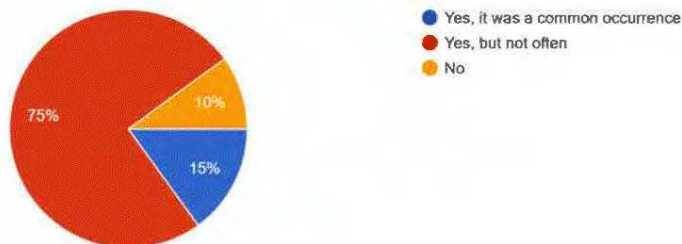
What are some features that would've made the nappy-changing process easier for you?

14 responses



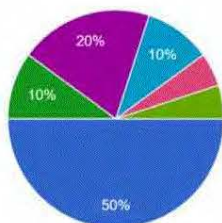
Did any of your babies experience nappy rash?

20 responses



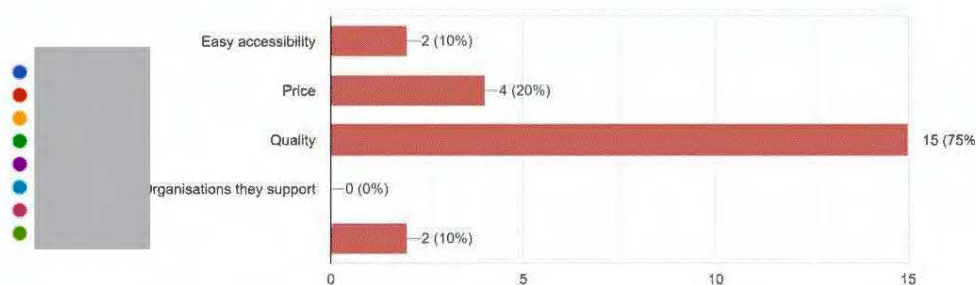
What brand of diapers was your go-to?

20 responses



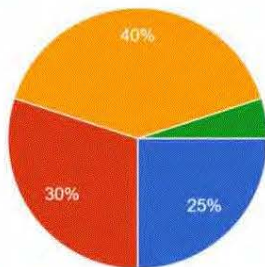
Why did you choose this brand?

20 responses



Do you know anyone who uses/has used cloth diapers as opposed to disposable ones?

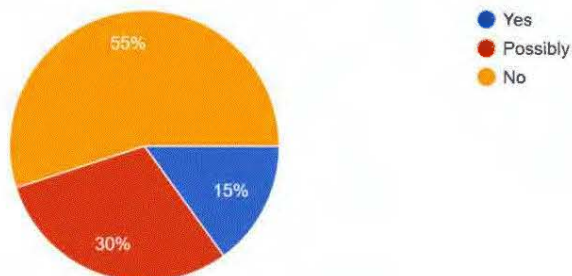
20 responses



- Yes, I know someone who's used them recently
- Yes, but not in this century
- No, I don't know anyone
- I did, did not like, u have to wash them!

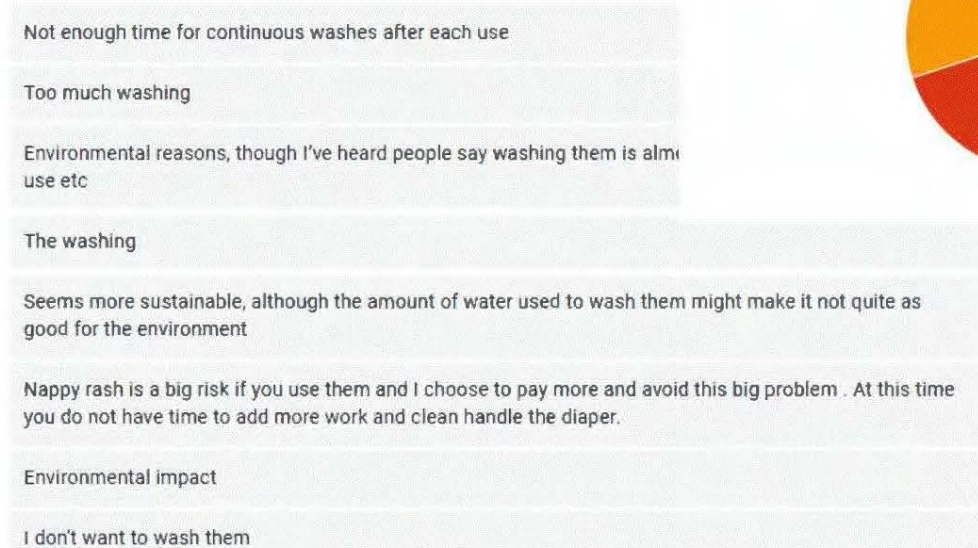
7) Would you consider using reusable natural cloth diapers for your baby?

20 responses



Why/why not?

15 responses



Evaluation on Parents Survey Responses

From the 20 answers I gathered from my wider stakeholder group of parents, my thinking was informed to create and test design features aligned to these issues in my conceptual development stage.

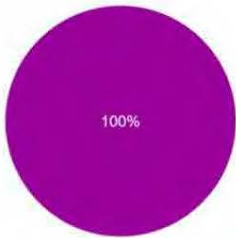
Parents Responses	Possible Solutions
The majority of parents found it difficult for their babies to hold still during nappy changing	Using softer and fluffy fabrics for the baby to lay on may encourage relaxation and comfort to stop them from wiggling around. Possibly a design feature on the diapers that the baby can fidget with during changing times so that the baby is distracted with a hands-on task.
An issue raised was excrement getting everywhere	Make my insert longer at the back to ensure full coverage and make sure the insert is absorbable and thick enough. I will test in my conceptual development ways to ensure the excrement and pee stay contained inside the diaper and create as little mess as possible.
An issue raised was nappy materials not being absorbent enough	Cotton and bamboo are very absorbent materials. I could compare the absorbency of the materials in comparison to disposable diapers in my trialing and testing.
An issue raised was the nappy not being sturdy enough	For sturdier nappies, I could create a harder outer shell, which would also help with the nappy staying open easier when unfolding it as someone suggested.
Parents wanted clear instructions on packaging/fewer steps	As part of my packaging, I could include step-by-step instructions with photos or a link to a video tutorial on how to put my diapers on.
Nappy rash is something that 90% of the parents surveyed struggled with	Cloth diapers could address this need and reduce the number of nappy rashes due to the lack of harmful chemicals in natural materials when in comparison to synthetic polyester disposable diapers.
A parent who had used cloth diapers before stopped using them because the washing got annoying	This is an unavoidable aspect of cloth diapers as you have to wash them in order to reuse them. Maybe there's a way I can make the journey from the changing to the washing machine easier by having the inserts fold in on themselves with no leaks allowing an easy clean, as all the excrement remains in one area or goes out through the sides.
An issue raised was that it wastes a lot of water to keep washing the inserts	Research has proven that it takes more water to produce disposable diapers than it takes to wash cloth ones.
An issue raised was that you have to continuously wash the insert	A possible solution to this is having multiple inserts so when you take out one insert to wash you put in the unused clean one into the outer shell (which doesn't get dirty) so you don't have to wash and dry it before being able to change your baby's diaper again.

Another important conclusion I came to from these survey responses was that parents are most concerned about the quality of their babies' nappies. I assumed most parents would have chosen their diapers based on competing prices, however, quality was prioritised by far. Because this is something my target market is concerned about I will have to focus on the quality of my diapers making sure they meet up to social acceptability standards within my target audience.

Clients Responses

What did you consider the trickiest part about changing your baby's diapers?

1 response



- Your baby not holding still
- Excrement getting everywhere
- Not Knowing which way was the front of the diaper and which was the back
- Didn't have the correct sizing options
- and option 1- couldn't select more than one

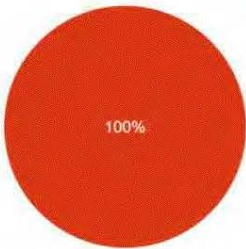
What are some features that would've made the nappy-changing process easier for you?

1 response

Easy straps/ adjustable tightness to make the nappy fit better. And the fitting around the legs

Did any of your babies experience nappy rash?

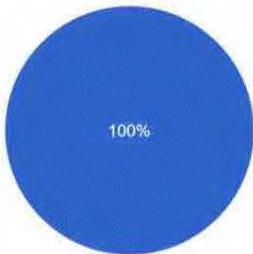
1 response



- Yes, it was a common occurrence
- Yes, but not often
- No

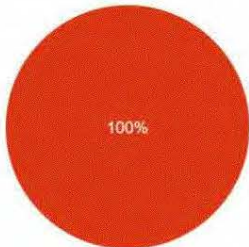
What brand of diapers was your go-to?

1 response



Why did you choose this brand?

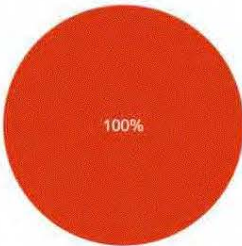
1 response



- Easy accessibility
- Price
- Quality
- Organisations they support

7) Would you consider using reusable natural cloth diapers for your baby?

1 response



- Yes
- Possibly
- No

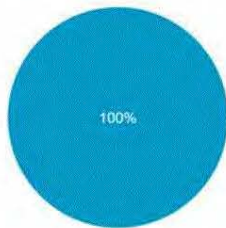
Why/why not?

1 response

The mess of cleaning them afterwards/ and also having to learn the right way to tie them

When would you use my cloth diaper the most?

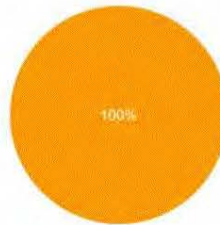
1 response



- At home
- During tummy time/play time
- Out and about
- Night-time
- At kindy
- Opt 1 & 2- I couldn't select more than one

What are you most hoping to gain out of this product?

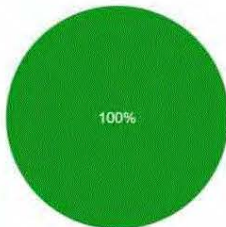
1 response



- Economical benefits
- Reducing your environmental impact
- Avoiding your babies skin reaction to the harmful chemicals in disposables/ nappy rash

What features would you prefer to be included in these nappies regarding the changing?

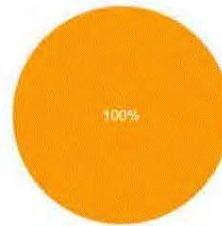
1 response



- Adding an insert that can be flipped inside out when removing - like a dog poo bag
- Pop buttons to fold the gauze insert in on itself and pop to close and contain the contents
- Only pop buttons attaching the gauze to the outer shell
- Opt 2 & 3- couldn't select both ideas

Would you rather have pop buttons or Velcro to secure the gauze insert to the outer shell?

1 response



- Pop buttons
- Velcro
- could it be both? - velcro seems less heavy but open for options

How would you wash the reusable gauze inserts?

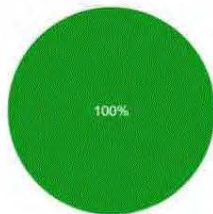
1 response



- Washing machine
- Hand wash

What materials would you prefer to be used?

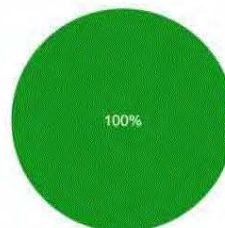
1 response



- Cotton
- Bamboo
- Organic hemp
- cotton/ merino wool blends- silk/cotton or something else soft

What colours would you want the outer shell to be? (naturally dyed)

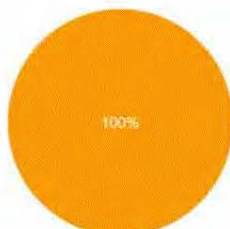
1 response



- Pink
- Purple
- Yellow
- Mauve pink/ dusty pink/ blush

Would you want a more neutral coloured diaper so that the colour doesn't show through underneath clothing?

1 response



- Yes
- No
- I dont mind seeing them- then it looks like a pant set/ or undies under dress. But needs to be good size to fit leggings over top

Clients Responses	My Thinking
Disposable diapers don't usually fit right on [REDACTED]	The adjustable tightness won't be a problem for my diapers as I am going to add pop buttons or velcro to be able to adjust the sizing around the waist so that it can also be modified as [REDACTED] grows older and gets bigger. For the fitting around the legs, I could get measurements in order to make it unique to [REDACTED], I could also test elastics around the leg part to see if that stretch allows for a better fit.
[REDACTED] has suffered from nappy rashes in the past	Hopefully, [REDACTED] will notice a difference when it comes to nappy rash when using cloth diapers versus using disposable ones as the harmful chemicals in disposable diapers could very well be causing this reaction, or making it worse.
[REDACTED] uses the brand Huggies for her diapers	Maybe by looking into the design and measurements that [REDACTED] use, I could replicate some of their features into my own diapers to add familiarity and comfort.
A reason [REDACTED] haven't tried disposable diapers is because of the washing that comes with them, and because she doesn't know how to tie them	While washing them after each use is inevitable, in my concept development I will test ways I can easily wrap up the contents after use to dispose of them easier and make the cleaning process less messy. As for learning to tie them the right way I will try to design my cloth diapers as straightforwardly as possible, and my packaging can include step-by-step instructions with pictures on how to put them on and all the different features available, how to adjust them to maximise comfort. Or, I could also have a QR code that leads to a video tutorial on how to put them on the right way and all the different features/adjustments.
[REDACTED] will use these diapers on [REDACTED] at home during tummy time/playtime	This means I can adapt my physical and social constraints as the diaper is not something that will be worn and seen outdoors, but rather used indoors.
[REDACTED] liked the idea of rolling up the inserts once they needed cleaning and the idea of attaching the insert to the outer shell using pop studs	I will trial and test these features and ideas in my concept development stage where I can make a toile/make sketches of these features and show Louise to see which one she prefers.
The inserts would be washed in a washing machine	I'd have to trial and test washing the inserts on different cycles/temperatures to ensure that my inserts are washing machine-safe.
[REDACTED] would want the diapers to be made from natural materials like cotton, merino wool blends, or silk	I hadn't thought about using wool blends but I have read that this is a recommended fabric for cloth nappies. I will have to trial and test these different materials and see what pros and cons they each have and decide, along with [REDACTED] preferences, which one I should use. It could be made from a mixture of them e.g outer shell - woollen, inserts - cotton.
[REDACTED] would like the outer shell of the diaper to be a mauve/blush pink	I will test achieving this colour through natural dyeing methods - using avocado seeds, I will show [REDACTED] my different patch tests and see which shade she prefers.
[REDACTED] should be able to wear leggings over top of them	I will need to ensure that I make them fitted enough so that [REDACTED] can comfortably wear them under leggings.

are open to having the insert being two separate halves or one long pad shape

I will consult with during my conceptual development and show her some of these features so she understands them better and can make an informed decision about what she prefers.

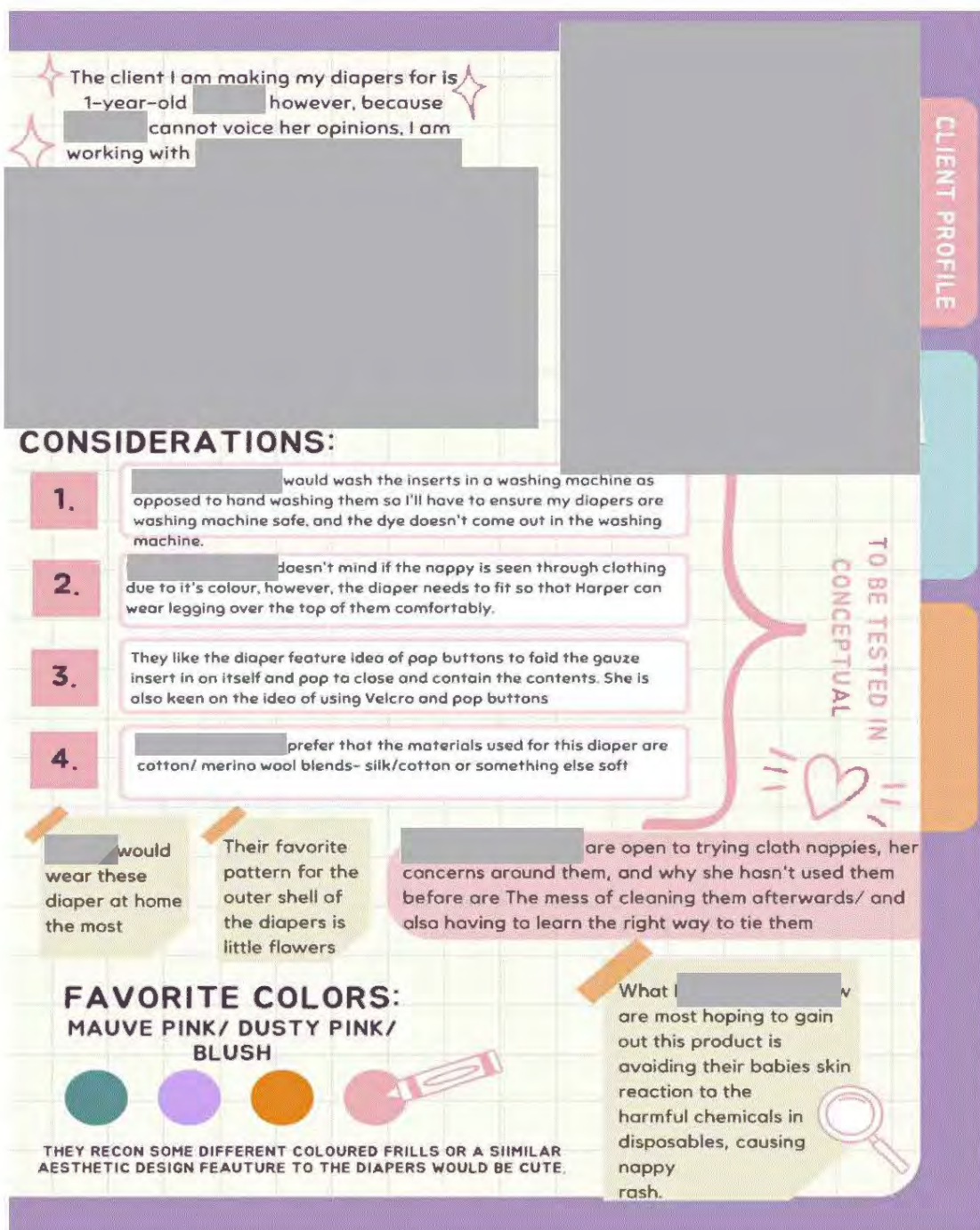
Stakeholder Feedback

'Some of the features you've come up with are so cool I wish the cloth diapers I used on my children had those features it definitely would have been a lot easier. Seeing some of the responses to not wanting to wash them, I understand that a social change is that mothers now tend to work and so they may not have time to wash them, whereas I was a stay at home mum and washing wasn't too much of a problem for me.' - Grandma

My Thinking

I am happy with the amount of responses I got from parents. I think this has given me a wider perspective and has informed my thinking as to some of the tests I need to conduct during my conceptual stage to ensure technical feasibility and social acceptability. From the responses I gained from my clients, thinking has been informed to create a client profile, summing up the considerations and specifications I have to consider for my prototype to make sure it meets my clients needs and wants.

Client Profile



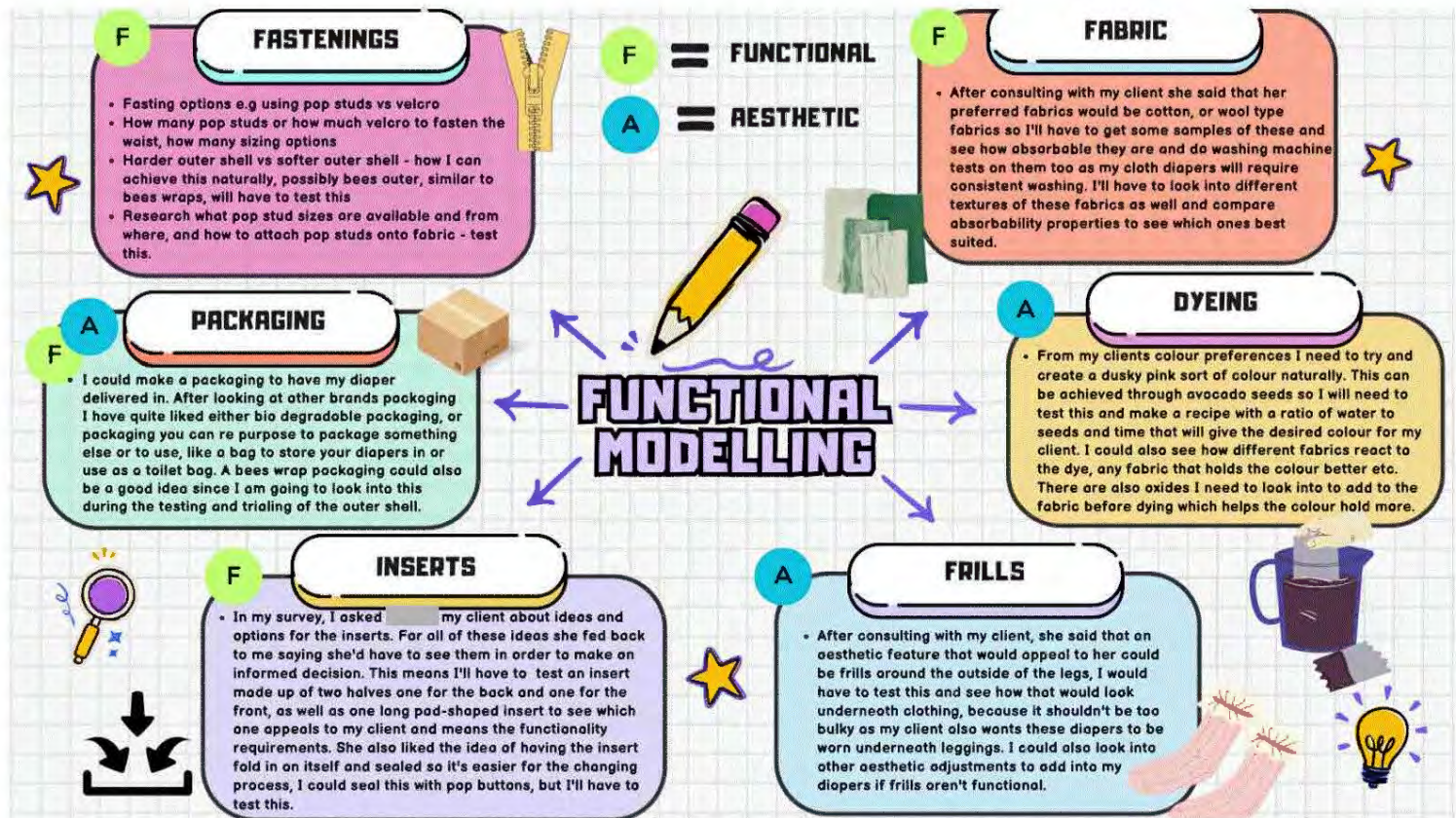
My Thinking

From the considerations gathered from my stakeholders, I am confident going into my conceptual development of my project and the different tests I need to conduct to ensure my outcome meets technical feasibility standards, social acceptability and the requirements of my clients.

Concept Development

My Thinking

Based on my survey results and evaluation, I'm going to brainstorm around some of the aspects and features I need to test in order to be confident in sewing my final outcome and ensuring it's fit for purpose.



Stakeholder Feedback

'I suggest you focus on the dyes first and find a method online with instructions on how to extract the dusky pink colour you're after from the avocado seeds and test that method. You could also look into mordents as some fabrics require mordants so that the colour seeps in better.' - [REDACTED]

My Thinking

From my brainstorm and this stakeholder feedback, my thinking has been informed to find a method online on how to extract a dusky pink from avocado pips/skins and to research possible mordants/what they do to the colour.

METHOD

1. Gather enough fabric or fiber for your project. Pre-wash and soak it in hot to warm water with pH-neutral soap. The fabric can be left to soak overnight to best take the dye evenly. It can be placed wet into the dye pot.
2. Fill your stainless steel dye pot with enough water to cover your material and have enough room for the material to freely move in the pot.
3. Add the whole avocado pits; the more pits, the darker and richer the hue and intensity of color will be. Do not cut or crush the pits. Bring to a low boil, then reduce the heat to a simmer. Simmer until the avocado pits begin to turn the water to pink and then a deep maroon. The color change will be visible in approximately 20 to 60 minutes. The deeper the color, the more vibrant the dye will be on your fabric. For darker color, the dye can be taken off the burner once the color has deepened and left to steep overnight.
4. Your material can be immersed in the dye pot either while the dye is still simmering over the heat or after the dye has steeped and cooled. Let your material soak in the dye bath for a minimum of 10 minutes. The longer the fabric soaks, the more vibrant the pinks and russet reds will be.
5. When the material reaches your desired shade, remove it from the dye pot with your stainless steel tongs. Rinse it in warm to cool water with pH neutral soap. Hang it to dry in the shade.
6. Applying the iron mordant (optional): You can make your own iron solution with rusty nails and water and a tiny bit of vinegar, or use iron powder. Only 2% of iron powder to weight of fiber is needed (a little goes a long way!). The solution can be used cold as an after-mordant. Let the fabric or fiber soak in the iron solution for at least 15 minutes for the best bond. Rinse in cool water and pH-neutral soap. Hang to dry in the shade.

LIST OF NATURAL MORDANTS

- Aluminum salts are the most commonly used mordants. They are easy to use and make natural dyes lightfast, washfast, and vibrant.
- Potassium Aluminium Sulphate (PAS or alum) can be used on animal fibers. It requires a hot mordanting bath. When combined with tannins, it works on plant fibers, too. Aluminium Acetate is a cold mordant that works best on cellulose fibers and silk.
- Iron salts can be used either as a mordant or as a



modifier, as iron "saddens" and darkens many dye plants

Stakeholder Feedback

'You need to test this method on fabric samples to see how the dye reacts to the mordants and to the different fabrics. Take into consideration that a darker shade of pink would be better because the colour might fade after washing. There are different weights of cotton out back, you should test each of these strips. I can also ask the food room to keep any avocado skins/pips for you so you can use their food waste for your project.'

My Thinking

From this feedback, my thinking was informed to test the three different weights of cotton, comparing pre-washed vs. non-pre washed fabric and how they react to different mordants too. I will also be testing the method above to see if it works.

FIRST TRIAL



Vinegar



Lemon Juice



Baking Soda

RESULTS



AVOCADO DYEING TESTS



- pre wash 40°
- canvas cotton fabric
- Avocado dye
- Taken out early, not left over night.



- pre wash 40°
- lighter cotton fabric
- Avocado dye
- vinegar
- no hand wash post



- pre wash 40°
- darker cotton fabric
- Avocado dye
- cold hand wash post.



- Non pre wash
- darker cotton
- Avocado dye
- baking soda
- warm hand wash post.



- pre wash 40°
- canvas cotton
- Avocado dye
- baking soda
- warm hand wash post



- Non pre wash
- lighter cotton
- Avocado dye
- lemon drops
- no hand wash post



- Non pre wash
- Dark cotton fabric
- Avocado dye
- No hand wash post



- pre wash 40°
- canvas cotton fabric
- Avocado dye
- no hand wash

After doing these tests at home I brought the samples with the different tests of mordants and fabrics to show [redacted] and get her stakeholder feedback on them. She said she really liked the ones that I had used the baking soda mordant with as they turned out to be a nice light dusky pink like my client wanted as opposed to the other fabrics with other mordants that turned out to be more brown. I was a bit concerned as these dyes were a little bit patchy in the sense that some areas of the sample were slightly lighter or slightly darker than others. [redacted] said that this was okay and that it was socially acceptable for it to be unevenly distributed a little bit because it adds to the natural vibe of it, and matches my target audience. She then continued to show me a TikTok she'd seen about a hiker who used reusable nappies and she clipped the used ones onto her hiking backpack/child carrier after she'd washed them to let them dry while she kept hiking. [redacted] suggested that I could make a clip too for my nappies, however, my client wouldn't use these nappies while hiking so I don't think it's necessary for this one but it could be a good feature for commercialisation.

I sent my client a photo of the different shades of the test patches and she was happy with the dusky pink I was able to create by adding the baking soda. From this feedback, I have confirmed that my tests were successful, and that I will need to recreate the method I used for that sample when dyeing my actual fabric.

Moving forward, myself and [redacted] discussed suitable fabric options and she said that canvas cotton like the fabrics I tried above would be suitable for the outer shell to give it that harder consistency and support. This discussion informed my thinking to take a trip to [redacted] and look at some suitable fabrics and get some samples.



This is the drill cotton sample that I got from spotlight. I showed [redacted] and she said that fabric would be suitable for my outcome, and she also suggested I test-dyed it as it was a bigger piece of fabric than what my little strips of samples had been, so I could get a more accurate indication as to what dyeing my pattern pieces will be like, and if the process will work.



Method For Avo Dye

- 1) collect the skins and pips (cleaned) of avocados from home and from the school food technology room over time and store them in the freezer until ready for use.
- 2) Fill up your pot with water and bring to a boil. Then reduce to a simmer and add the seeds and skins. Leave for one hour then turn off the heat and let the skins sit overnight.
- 3) Take out the skins and pips and bring to a boil. Add 1 teaspoon of baking soda, then add the pre-soaked fabric into the boiling mixture.



4) Mix around for 10 minutes - or until the desired pink shade starts coming through onto the fabric.

5) Remove fabric from the mixture and rinse it in cool water then put it out to dry in the shade.



'I think this bigger patch of fabric gave an even better result as the pink is brighter and less patchy, hopefully, you can recreate this colour for your actual.' - [redacted]

'The colour you achieved in this test was brighter than the one in your previous test despite following the same method. Because you're using natural dyes, they are

less predictable and controllable than synthetic dyes so you will have to keep a close eye out when dyeing your actual dye to make sure the outcome is what you wanted.' - Dad

From this test and from my stakeholder feedback, I am confident moving forward with my method that I will get the dusky pink fabric outcome my client desires. From this, my thinking has been informed to move on to concept sketches for my diapers.

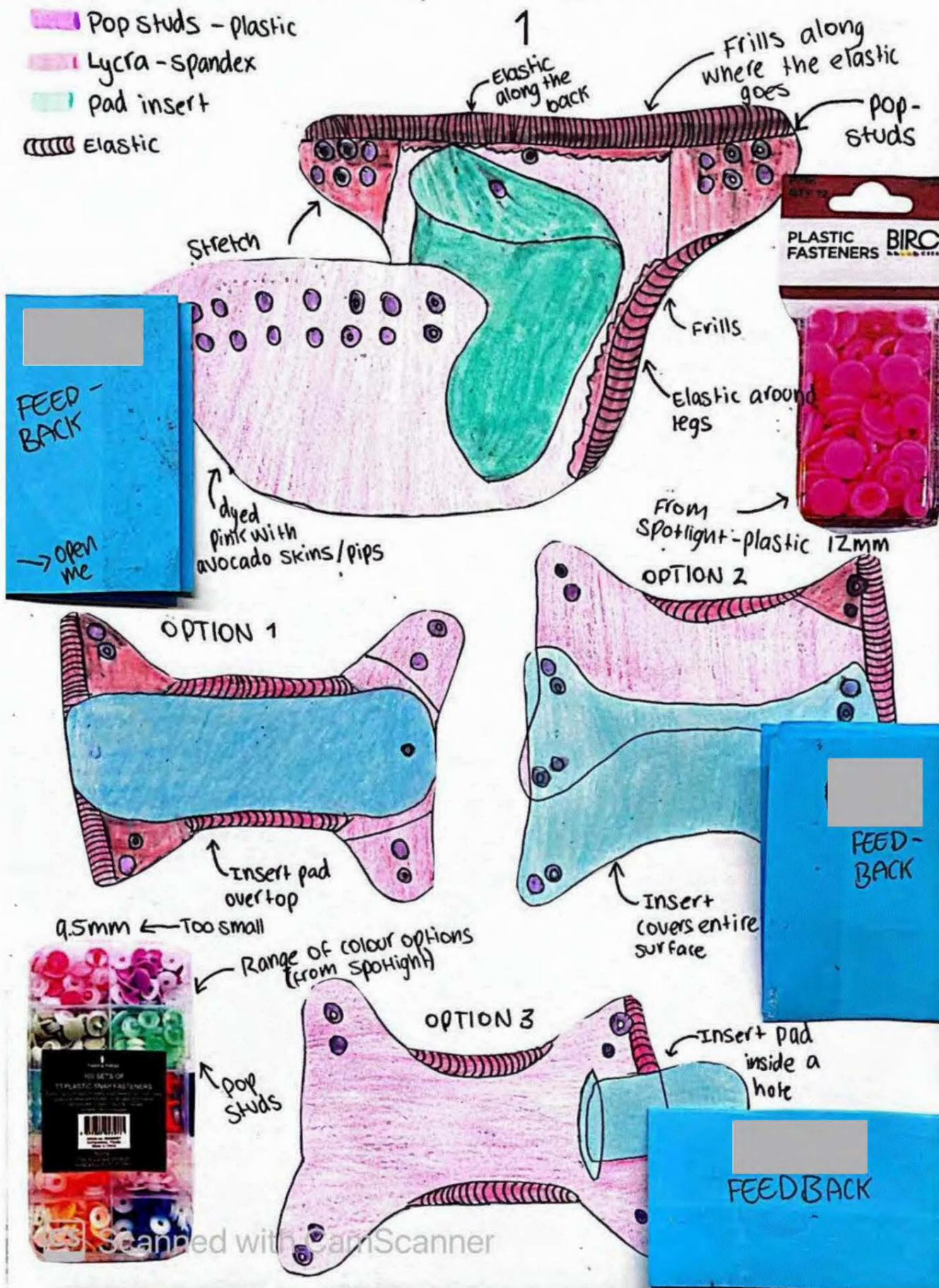
CONCEPT SKETCH

Pop studs - plastic

Lycra - spandex

pad insert

Elastic



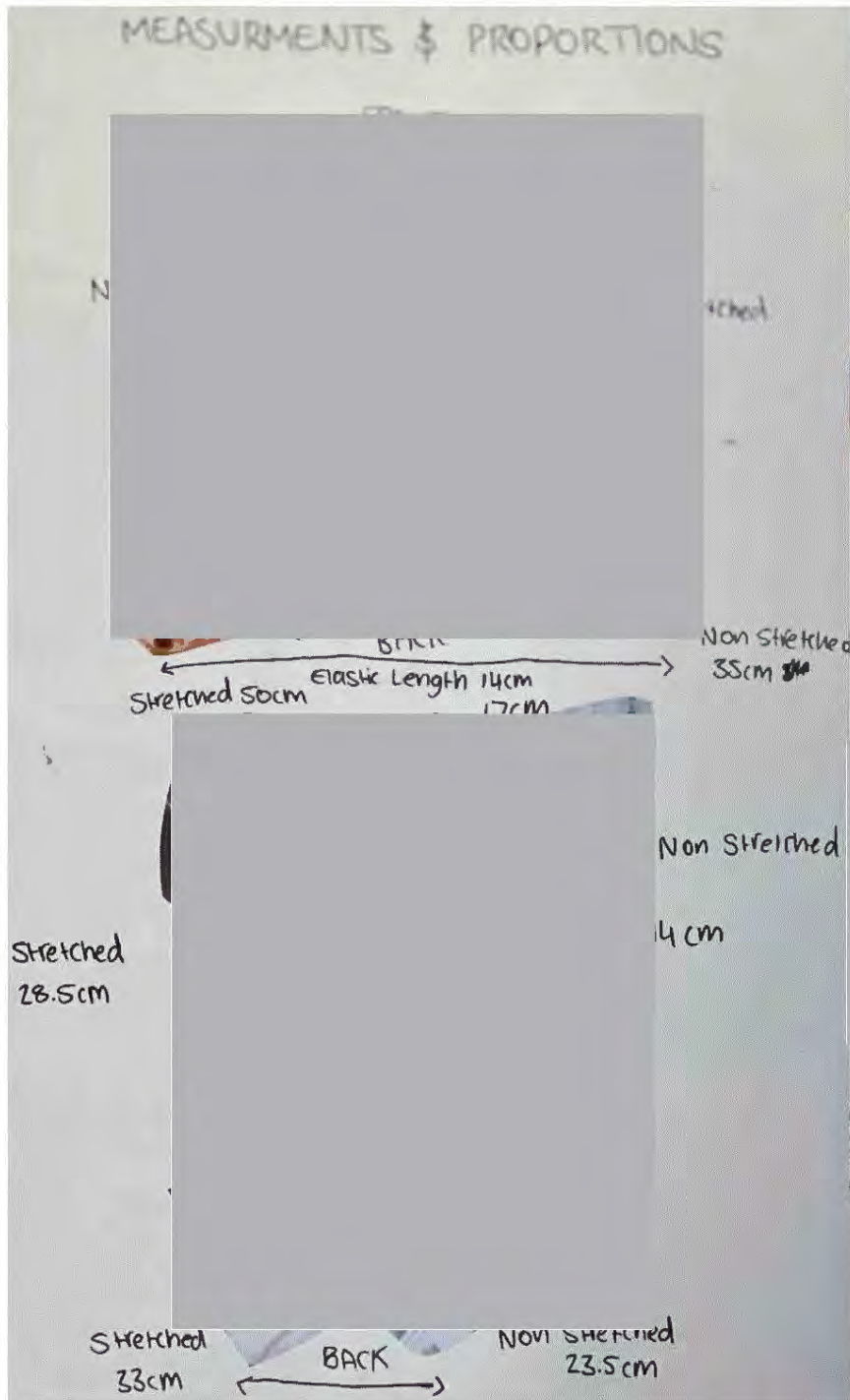
Stakeholder Feedback

'From looking at your first concept sketch, I don't think the pad option number 3 will be technically feasible as the fabric of the outer would get dirty meaning you have to wash both the outer and the insert which would not be socially acceptable. These designs are a bit hard to grasp from just these sketches, could you maybe make models of these?'

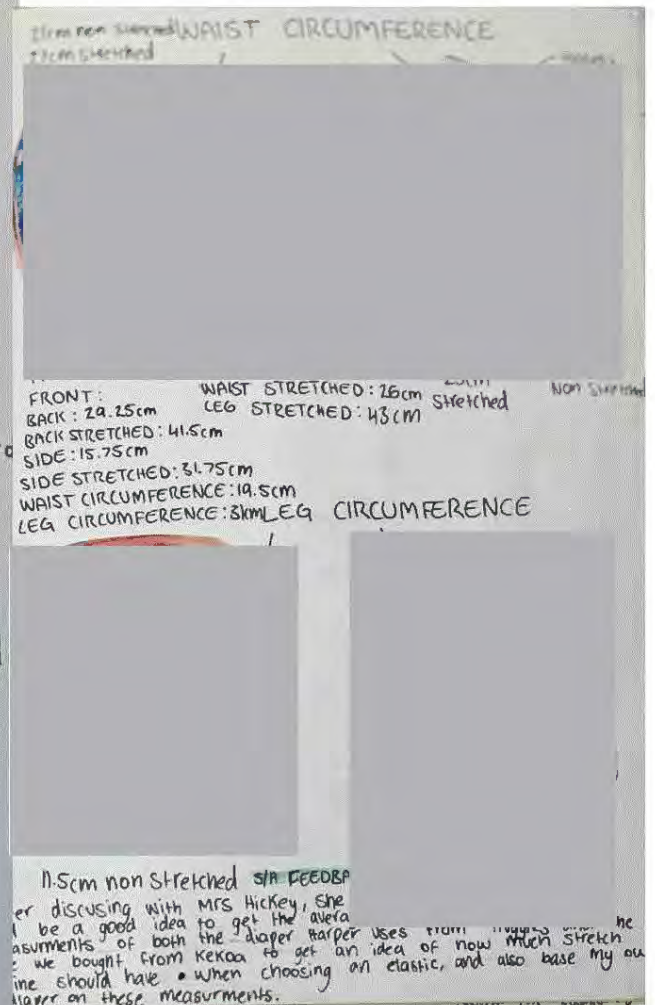
My Thinking

From this stakeholder feedback, my thinking has been informed to dive deeper into the 3 insert options/shapes and to critically evaluate each of them to see which one is the most technically feasible and socially acceptable option.

MEASUREMENTS & PROPORTIONS

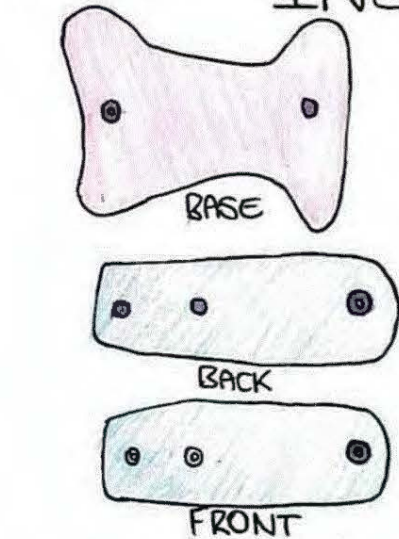


Measurements & Proportions



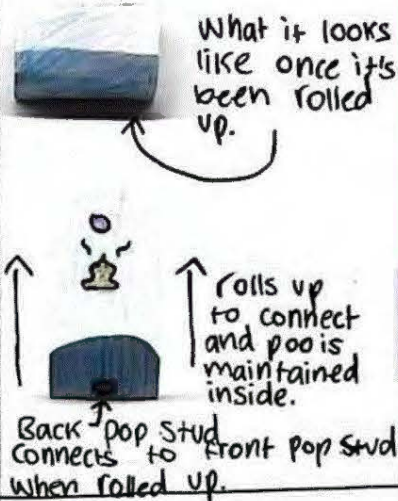
IMAGE

INSERT OPTIONS



OPTION 1

FUNCTIONALITY

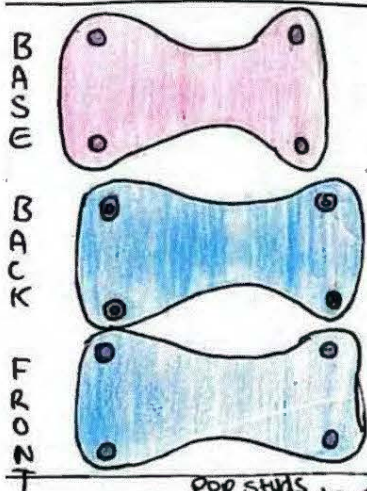


SH FEEDBACK

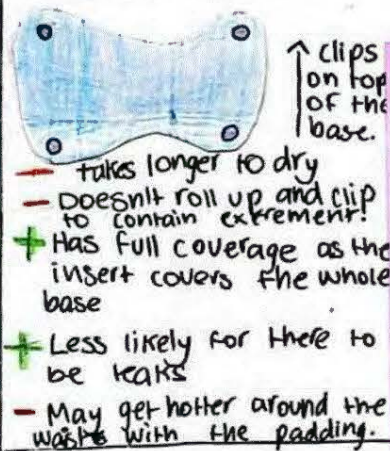
29/01

- shape of insert needs to cover more back

- can roll up & clip together to contain contents - no
- Doesn't cover whole base so may leak on sides.

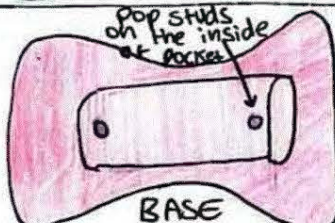


OPTION 2

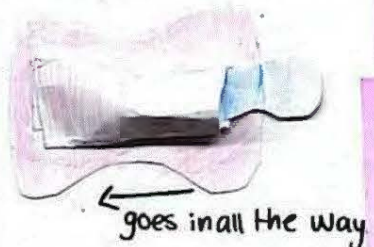


- Lets check over technical feasibility of insert against outside shape.

- make me 3D model to see shape of insert



OPTION 3



- + More layers due to the pocket so less chance of leakage.
- You have to wash both the outer shell/base & the insert when changing
- May be difficult to remove insert without getting your hands dirty.

• Pattern - Paper actual size/shape

• insert 2x shapes 1 2

• test - water - dye

• Miss H pop stud



Stakeholder Feedback

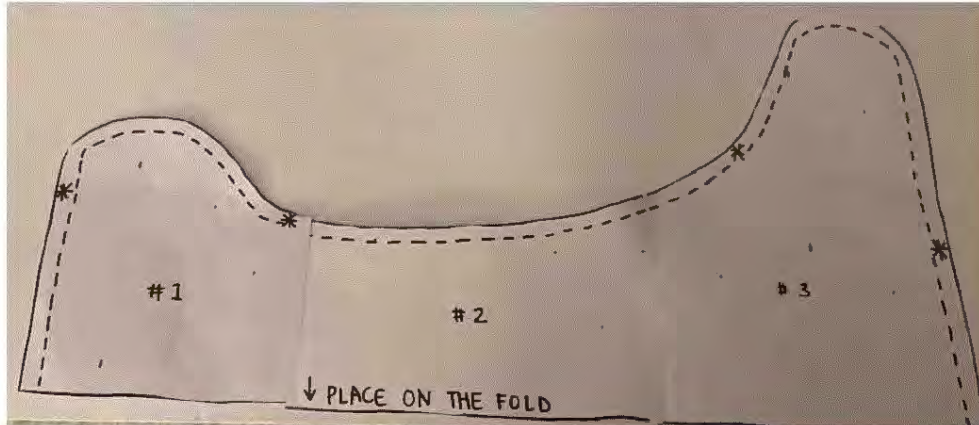
'I don't think the third option is technically feasible as it defeats the purpose of your project if you have to wash both the inserts and the outer shell. Could you try the insert shapes on a paper model of your diapers, including one that goes out to the sides a bit more as I have drawn on the post-it note? This will help you get a better idea as to how they will look on the diaper.' -

My Thinking

From this stakeholder feedback, my thinking has been informed to construct a paper toile of my diaper using my pattern and create paper insert patterns to get a clearer idea of how they would look together and if that design would be technically feasible.

Pattern Making

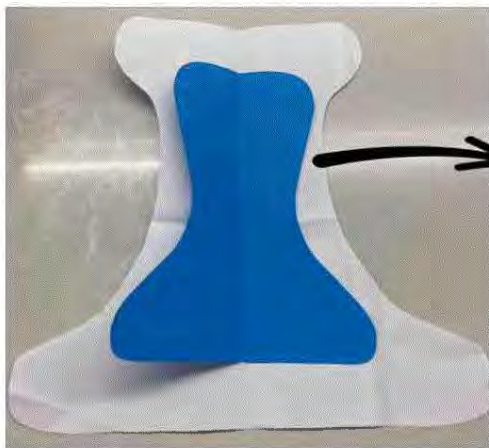
Due to there being no pattern on the market, I used functional modelling to design my own to ensure it met my clients needs. I used functional modelling of making paper cut outs, and considered the shape, technical feasibility and construction steps. This was my forms of functional modelling to ensure my prototype should, and could be made



I put the pattern piece along a folded piece of paper and cut it as I would with fabric to make a paper model of the outer shell.



This is the outer shell of the diaper, the circles indicate where the pop studs would be to connect to the pad insert, the top pop stud in the middle and the bottom middle would connect to the oval-shaped insert, and the top middle and two bottom sides would be used to connect the 'hourglass' shaped insert.



'Hourglass' shape insert

Oval shape insert



Stakeholder Feedback

'I think the hourglass-shaped insert would be more suitable than the oval-shaped insert as the oval one doesn't provide enough coverage on the back of the diaper and the excrement would slip to the back and leak in that area which would not be socially acceptable. Even though I like the hourglass shape better, I still think it would be better to extend the sides on the back to ensure full coverage so there are no gaps for the pee and poo to get into the outer shell.' - [REDACTED]

My Thinking

From this feedback, my thinking has been informed to use the hourglass-shaped insert as opposed to the oval insert as it ensures social acceptability by not having anything leaking down the back. My thinking has also been informed to extend the back flaps of the insert further outwards to ensure better coverage. I will compare the difference by using a different coloured paper insert model.



Comparison

Extended insert



Stakeholder Feedback

'I definitely think this extension on the sides gives it more coverage and it is more technically feasible as it ensures no unwanted leaks. My only concern is that the outer flaps are now too close to the ends of the outer shell, and keeping in mind a seam allowance, the insert will peek out from the outer shell and be visible which is not socially acceptable, nor would it be comfortable to wear.' - [REDACTED]

My Thinking

From this feedback, my thinking has been informed to create another hourglass-shaped pad, making sure I leave enough of a gap between the edge of the shell (the white paper) and the insert (the green paper).



Comparison to original

Adjusted to not touch edge



My Thinking

This green one was just the right size and it allowed space for the pop studs on the outer flaps and the flaps extended enough so that there wouldn't be leaks, all whilst not touching the outer shell. I measured the area (270 cm squared) and kept the piece of paper so that when it comes to cutting out my pattern, I can use this as a guide.

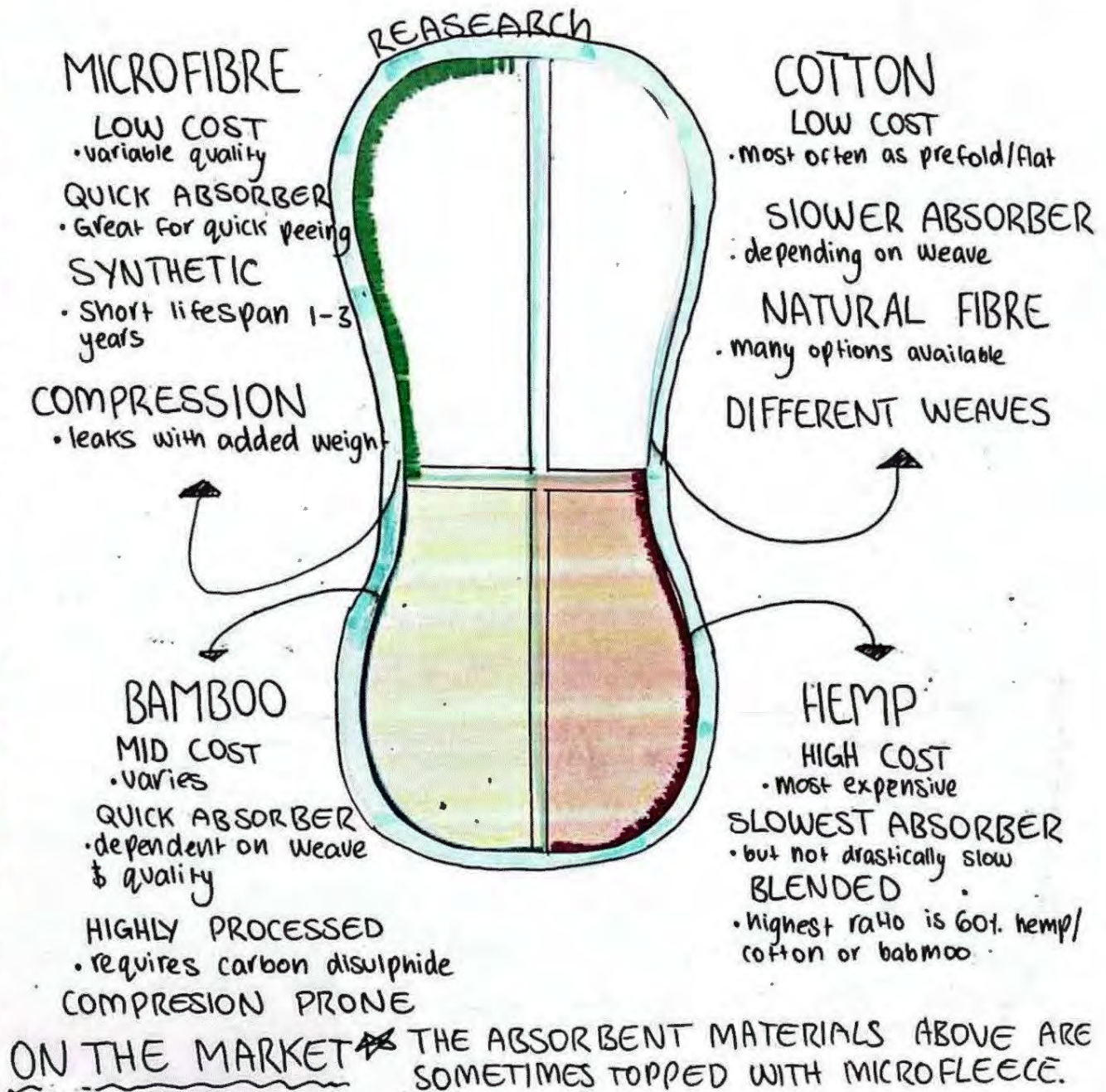
Where to Next

After having found a suitable shape/pattern for my insert, my next step is to look into insert fabrics to see what materials I can make mine out of, and which would be the most absorbent i.e. the most technically feasible.



Surface area of 270cm²

CLOTH DIAPER ABSORBENCY INSERTS



\$28

147cm

100% cotton

Loopback

Sweatshirting

This was the only toweling sort of fabric available at the Fabric Store, so I only collected this sample, thinking other materials wouldn't be suitable.

STAKEHOLDER FEEDBACK:

- 'Does it have to be a towelling fabric?', the Kekoia one we bought is a sort of stretchy cotton, we could also use a merino/cotton blend.' We cut open Kekoia inserts and they had stuffing so [redacted] suggests I do something similar with cotton

My Thinking

After conducting this research, I went to the fabric store in Ponsonby to see what kind of blends they had. The only suitable option was the towelling material above which was too thin and gave a cringe effect to the touch so I didn't think it was suitable as it is not socially acceptable to have a fabric that is uncomfortable touching your body directly, especially babies skin as they have more sensitive skin.

Stakeholder Feedback

'Does it have to be a towelling fabric? You should look at what [redacted] did with their inserts, cut them open if you need to to see what sort of fabrics you should be using.' - [redacted]



Inside the [redacted] insert

My Thinking

When I cut open the insert as seen above, I noticed that the inside was stuffed with wadding, possibly to enhance absorbability. The wadding they used felt like polyester which I don't want to use as it goes against my natural/organic fabric specification which would not be technically feasible.

Stakeholder Feedback

'You wouldn't have to use polyester wadding, there is cotton wadding available too that you could use to make a 'sandwich' to ensure your inserts are absorbable and cushioned.' - [redacted]

My Thinking

From this stakeholder feedback, my thinking was informed to get some samples of fabrics for the two outer layers of the insert and to look at some organic cotton wadding for the stuffing of the insert.

INSERT FABRIC

★ After discussing with Mrs Hickley on my first towelling fabric, I told her I'd look for further fabric options on my trip to Spain. I also said I'd focus on cotton fabrics because cotton/merino blends would be better to buy in NZ.

When I went to the fabric store in Spain I explained my diaper project to one of the store people and he showed me what was best suitable based on my specifications, as well as his expert opinion.

← WHITE BOUCLE

- + Thick COTTON
- + 100% Cotton
- Towelling fabric isn't very comfortable - it can make some people cringe.
- + Absorbable

STAKEHOLDER

FEEDBACK

MUM: I don't think towelling is the best option because it has a texture to it that makes you cringe, it also gets quite heavy when it's wet. The excrement could get caught on the loops, making it hard to wash.

← COTTON MUSLIN

- + Nice feel to it - soft
- + 100% Cotton
- + A bit of texture but not so much that it's uncomfortable
- + Not too thick but still absorbant so it will be perfect to sandwich the cotton wadding

STOREPERSON: out of the three, this one has the most comfortable texture to it, which is important to consider as babies have sensitive skin, and rough textures could irritate their skin and cause nappy rash. Although this fabric is thinner, it will go nicely with the cotton wadding.

← COTTON WAFFLE PIQUE

- + 100% Cotton
- Rough Waffle texture may be uncomfortable on the baby's skin as theirs is more sensitive
- Excrement could get caught in the squares, making it harder to clean.

MUM: This is my least favourite of the three, the waffle texture is too rough for a baby's bottom and the poo will get caught in the squares, making it hard to clean.

STOREPERSON: Despite its absorbant appearance, this fabric is probably just as absorbent as the muslin.

← RAW COTTON WADDING (for in between the layers of fabric)

- + 100% cotton - so not like the polyester wadding

← Synthetic

STOREPERSON:

This wadding is 100% natural, unlike the polyester wadding, and it is very absorbable.

My Thinking

The stakeholder feedback of my mum and the storeperson led me to choose the cotton muslin as the outer for my inserts and the cotton wadding for the inner layer as that would be the most technically feasible option. I also agreed that that was the most suitable option. After finding the fabric for my inserts, I decided to test how many layers I would need for the cotton to be absorbable so I did some absorbability tests using the area I calculated for the pad insert.

Absorbability Tests

I conducted these tests to ensure the layers of fabric could withhold the child's urination for the period of time

ABSORBENCY TESTS

LAYERS

AREA = 30cm²



CALCULATIONS
 1 20 drops until it went through to the other side.
 L
 A 1.25ml absorbed
 Y $\frac{1.25}{30} = 0.04 \text{ ml/cm}^2$
 E
 R Therefore on the actual pad (270cm²) it will absorb $270 \times 0.04 = 11.25 \text{ ml}$

S/H FEEDBACK
 DAD: He's the one who suggested I work out the surface area of the actual pad and helped me calculate how many ml's it would absorb.

From this my thinking was informed to research how many ml's babies pee.

FLIP ME



2 30 drops until it went through to the other side.
 L
 A 1.6ml absorbed
 Y $\frac{1.6}{30} = 0.05 \text{ ml/cm}^2$
 E
 R Therefore on the actual pad (270cm²) it will absorb $270 \times 0.05 = 14.4 \text{ ml}$

After researching I found that on average 1 year olds pee 30-40ml, which means that both 1 layer and 2 layers wouldn't sufficiently absorb this which is why I had to test 3 layers of the cotton wadding.



3 40 drops until it went through to the other side.
 L
 A 2.5ml absorbed
 Y $\frac{2.5}{30} = 0.08 \text{ ml/cm}^2$
 E
 R Therefore on the actual pad (270cm²) it will absorb $270 \times 0.08 = 22.5 \text{ ml}$

Because the 3 layers of the wadding didn't absorb 30-40ml, you should do another test with 4 layers to ensure it is fit for purpose.
 -Mrs Hickey

This feedback informed my thinking to conduct a 4th trial. below



4 50 drops until it went through to the other side.
 L
 A 2.9ml absorbed
 Y $\frac{2.9}{30} = 0.10 \text{ ml/cm}^2$
 E
 R Therefore on the actual pad (270cm²) it will absorb $270 \times 0.10 = 27 \text{ ml}$

Dad: I think you should do another test to ensure your pad will absorb the 30ml average that 1 year olds pee.

To ensure I met my brief specifications I'm going to try 5 layers.



5 65 drops until it went through to the other side. 4.1ml absorbed
 $\frac{4.1}{30} = 0.14 \text{ ml/cm}^2$
 R Therefore on the actual pad (270cm²) it will absorb $270 \times 0.14 = 37.8 \text{ ml}$

DAD: I think 5 layers is the perfect amount because it covers the average range of 30-40ml and it will ensure there's sufficient absorption for no leaks. It's also not too thick, but it's actually comfortable with the cushioning.

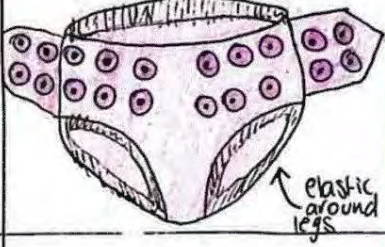
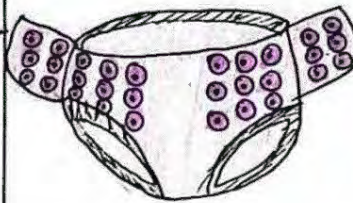
My Thinking

From these tests, and from my stakeholder feedback, my thinking has been informed to use 5 layers of cotton wadding in between the cotton muslin to ensure that all the pee is absorbed and the nappy remains dry. I have chosen 5 layers to ensure social acceptability as it would not be socially acceptable for me to have an insert that doesn't absorb the average mLs of pee for a 12-24 month-old as that's my target market. My next step is to look into pop-stud placements.

Pop Stud Concepts

I designed various pop stud concepts to test for stability, comfort and practicality

TABS AND POP STUDS CONCEPTS

CLOSED		OPEN	S/H FEEDBACK
FRONT	BACK	 elastic along the back elastic around legs	Spacing of the pop studs. • stability. • comfort • practicality. Can it work when child is wriggling?
FRONT	BACK		
FRONT	BACK		
FRONT	BACK	 elastic all the way around elastic around the legs.	29/07 test 1 - 1 layer (3) - cotton insert - feedback. test 2 - 2 (4) test 3 (5).
FRONT	BACK		
FRONT	BACK		
STRETCHY NAPPY PANTS			29/07 No to opt 3 as the pulling affect will defeat the purpose of the overall concept pulling -> outside dirty.

Stakeholder Feedback

'I think the rounded shape of the outer tabs is the most suitable as the triangle shape will be too sharp and might poke the baby which would not be socially acceptable. The elastic all the way around removes the aspect of different sizing that the pop studs create which wouldn't meet your specification of having a size range of 12-24 months age. As for the pop studs, I don't think one row will be strong enough as the fabric may rip and we want to ensure your diapers are durable. Parents should be able to carelessly rip off the tabs from the pop studs if they were to be in a rush and they should be sturdy enough to stay on, otherwise, that would not be socially acceptable. I think two rows of pop studs will be the most suitable as three would be too many to clip on and take up too much time for the changer. You should test the spacing of these pop studs to make sure they hold and they are technically feasible.'

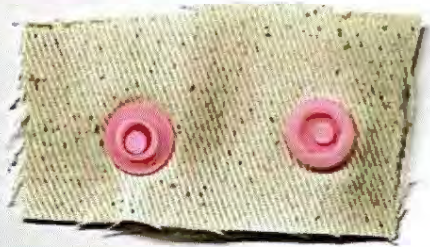
My Thinking

From this stakeholder feedback, my thinking has been to test different pop studs and their durability to see how many layers I need to ensure it doesn't rip the fabric or undo the pop studs.

Pop Stud Durability

I tested this to ensure it could withstand the human interaction of ripping off the pop studs when using the diaper.

POP STUD TESTING

SAMPLE	S/H FEEDBACK	MY THINKING
	DOUBLE LAYERED STRETCHY FABRIC METAL STUDS Double layers did not work for this one and the fabric pulls/rips when you try to fasten the studs.	The double layer isn't functional as the fabric rips, so I'm going to try with an interfacing in between.
	STRETCHY FABRIC WITH INTERFACING BETWEEN METAL STUDS This one's definitely better I don't feel like the fabric's tearing. There's a bit of a lump in between the studs, so you'll need to stretch the fabric.	Interfacing worked a lot better with strengthening the fabric so it doesn't rip. After looking at Kelco's diapers I saw that they used plastic pop studs, which may be more suitable for my diapers.
	1 LAYER COTTON PLASTIC STUDS MUM: This one feels more secure than the metal ones even with just one layer. I think the pink will go nicely with the pink fabric too.	After looking into patterns, I saw that they didn't use elastic/stretchy latex for the sides, they just used the base fabric which is why I've tested these with cotton. I think the pop studs connect a lot more secure to the cotton.
	2 LAYERS COTTON PLASTIC STUDS MUM: I think two layers is more secure than one and it will ensure it's fit for purpose, and it doesn't tear the fabric after multiple uses.	Two layers is how many my diapers would have because the pattern is double layered so this gives me a good idea of how secure that would feel. Even though they feel pretty secure I'm going to test it with interfacing to make sure it's

My Thinking

From these tests, my thinking has been informed to use a double layer of fabric for my pop studs as it feels very sturdy and it won't rip the fabric, ensuring social acceptability and technical feasibility. The double layer works well with my pattern because the outer shell is automatically a double layer. Because this is a small sample, I am going to replicate these two layers with the actual size of the shell to also test for spacing to ensure no holes are ripped and that the pop studs remain durable.



SPACING:

Width = 3cm apart from each other
 Height = 3cm apart from each other > perfect square

MY THINKING:

using my pattern, I replicated what the front of the diaper will look like + the actual measurements and I recreated the flap on the back of the diaper that comes around to the front to connect so that I can get a good idea of the functionality of these pop studs on my diaper, and if the spacing would work. I also used the same fabric, previously to the dyeing.

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STAKEHOLDER FEEDBACK =

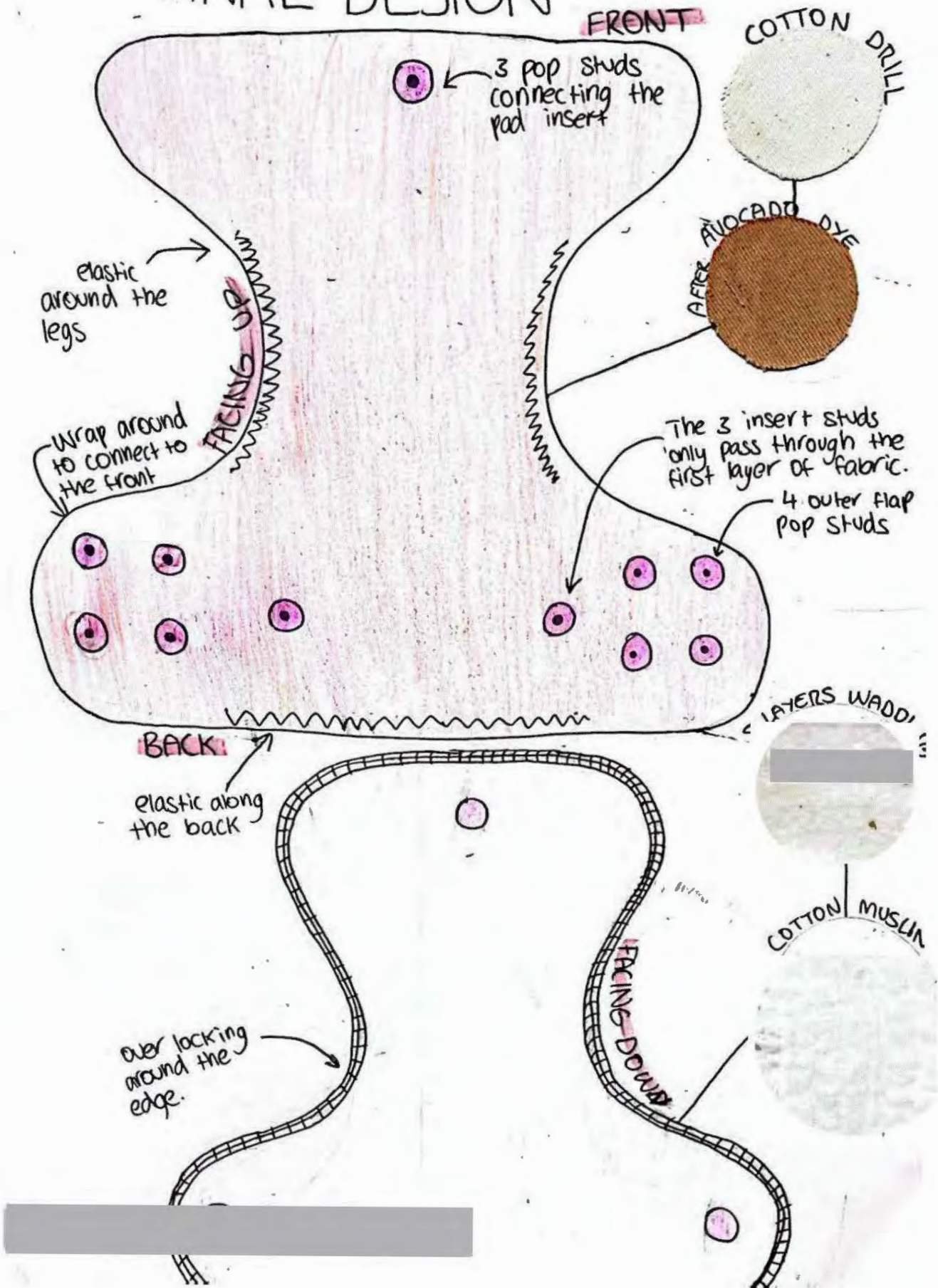
DAD: When you asked me to fasten it, at first I was being gentle, because I didn't want to break it, but when you told me to go for it and rip, I realised just how sturdy the pop studs were.

MUM: I think the spacing of the pop studs will make your diaper technically feasible. After try it various times, it feels very sturdy and durable, something your outcome will need as you want it to have a long life cycle.

Justification:

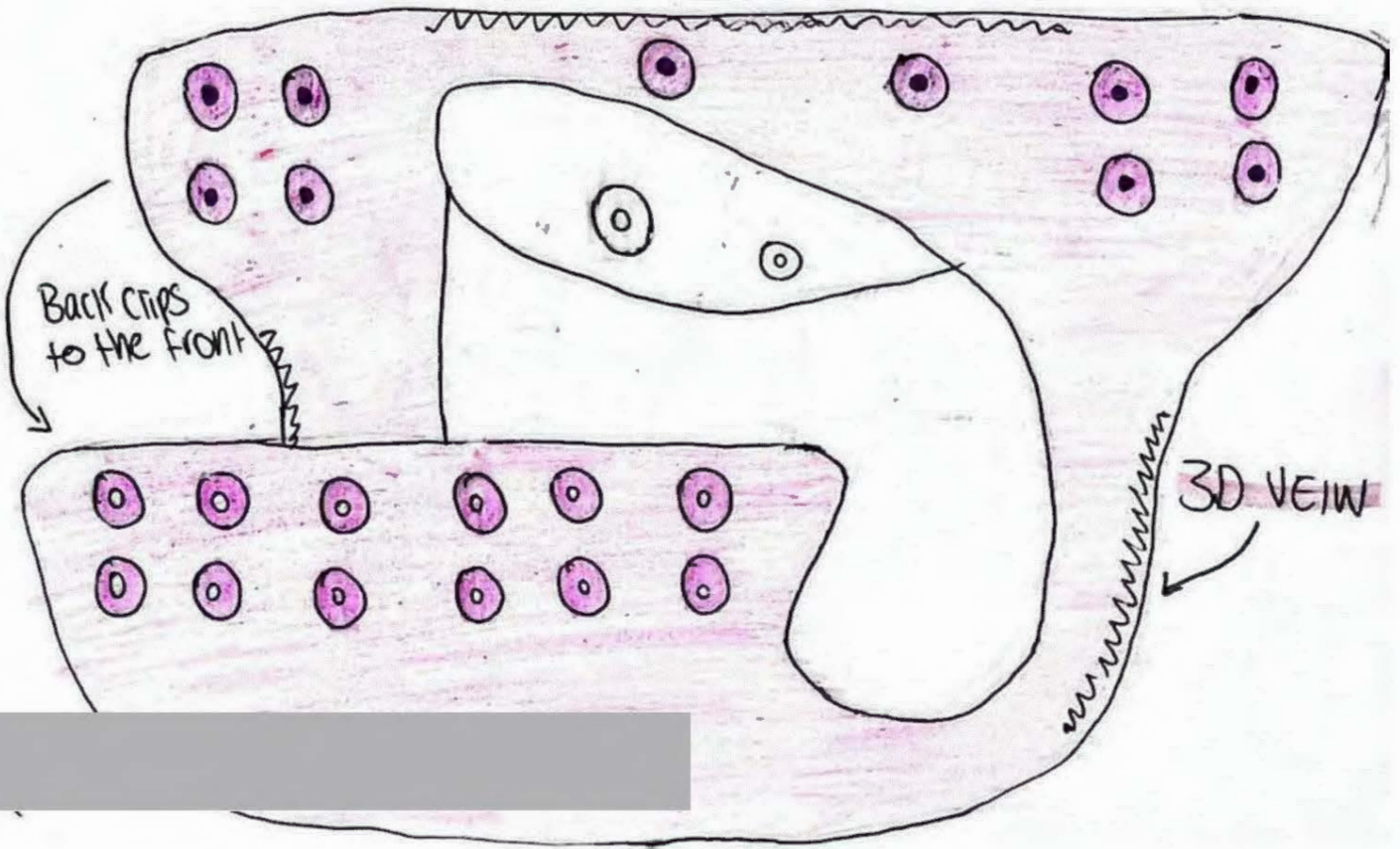
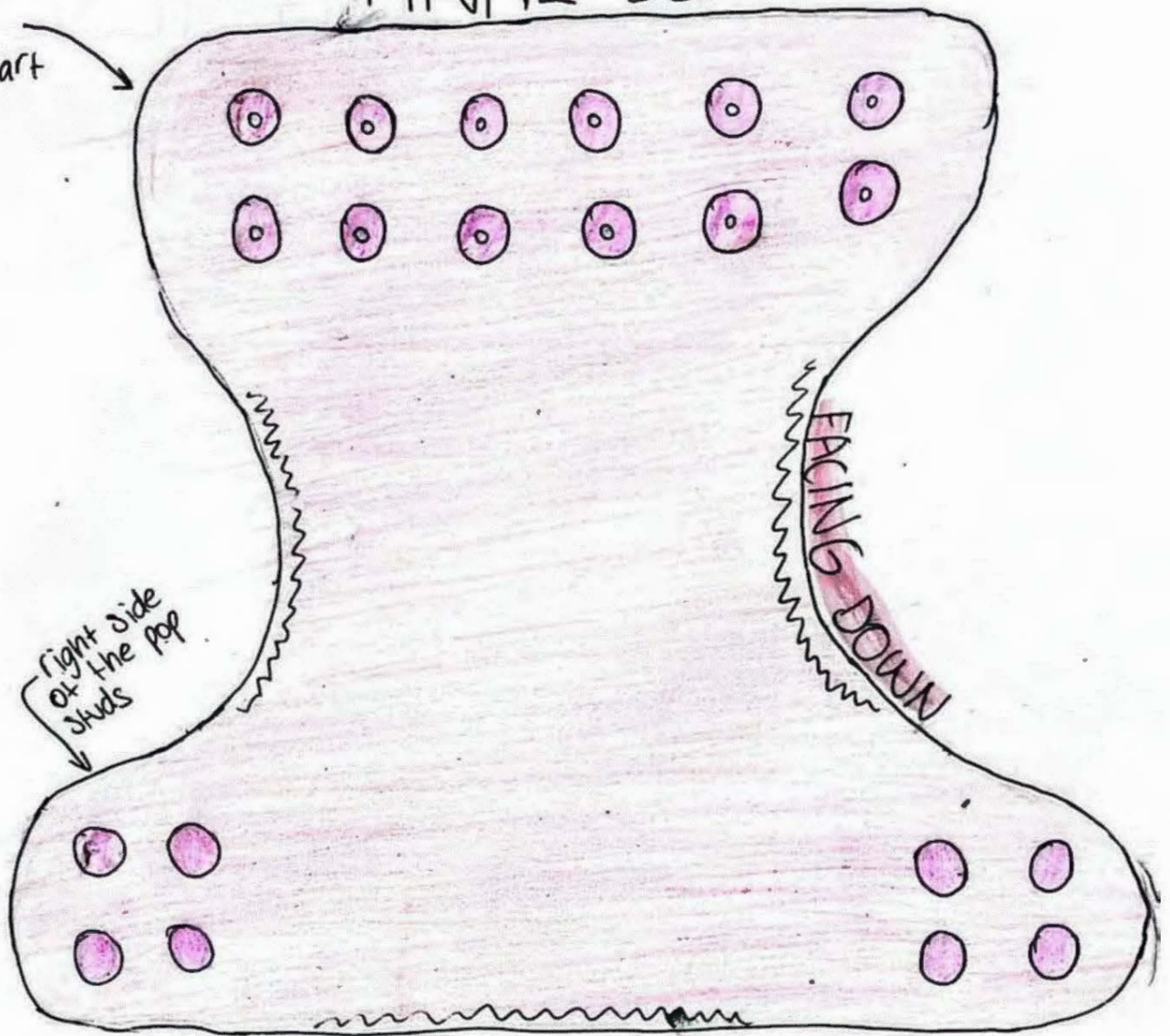
From my pop stud spacing tests and my stakeholder feedback, my thinking has been informed about spacing the pop studs 3 cm away from each other both horizontally and vertically. This ensured technical feasibility and social acceptability as my pop studs won't rip out when taking off the diaper no matter how indelicately or quickly you pop them off. My next step is to create a final design sketch combining all the features I selected in my trials and tests.

FINAL DESIGN



FINAL DESIGN

spaced
3x3cm apart



Evaluation of Fitness of Purpose

The tests I have conducted in my conceptual development stage have ensured the technical feasibility and social acceptability of my product to ensure it's fit for purpose and it can actually be made. My final design meets these brief specifications because my outcome will be made from entirely natural fabric (cotton) using cotton drill, cotton wadding, and cotton muslin. Cotton was one of the fabrics my client preferred too, so I am meeting her criteria. My outcome links to my SDG number 13 because I am naturally dyeing the fabric pink from avocado skins/pips collected from food waste/scraps from the food tech room and from my own home to avoid the toxic chemicals in artificial commercial fabric dyes to get into our waterways, or damage and irritate the babies sensitive skin. From my dyeing test, I have met the specification of creating a dusky pink colour, however, I am changing the specification of having frill or flowers because when I tested creating patterns with lemon juice on the avocado dye it didn't work out very well and it looked nicer with just the pink all over. My product also links to my SDG because of the increased lifecycle. Disposable diapers only have one use and then are thrown into landfill where they take up to 500 years to decompose. This reusable cloth diaper has allowed for an extended lifespan and an eco-friendly decomposing when that lifespan has been used up as the natural fabric used to make it will act as compost and plant food. Keeping in mind, and looking back on the comments and replies that [REDACTED] gave me on my survey, I have constructed a final design in which her ideas and suggestions are included, to ensure my outcome matches her desires. I have designed my final outcome so that the outer shell does not need to be washed, as the insert is removable and will soak up all the excrement, so I have not done a washing test on the outer. However, in my prototyping stage, I will conduct a wash test on the inserts to ensure I meet this specification. My final design is socially acceptable and technically feasible for [REDACTED] to use at home and during tummy time/playtime which is where her intended setting is because the cushioned insert and supportive outer shell allow for [REDACTED] to move easily and freely while being comfortable. My final design meets the specification of having adjustable sizing through the use of pop studs on the back outer tabs and along the front of the tummy so that you can adjust the waist size. The elastics along the back and on the two legs also allow for different sizing as they can stretch to where needed. My final design meets the specification of having a washable insert that you can easily remove and wash without having to get the outer shell dirty. I believe I am on track to meeting my deadline specification as I am meeting the deadline for conceptual development hand in (06/08/24), and I am ready to get straight into my prototyping stage due on the 24th of October due to us pushing the deadline for conceptual development back.

Prototyping

Toile

My Thinking

Once entering the prototyping stage, I still hadn't made a toile, and I needed to do so to ensure my final prototype would be technically feasible and socially acceptable.

Toile 1



My Thinking

Although I tested pop stud spacing on the upper portion of a diaper during my conceptual stage, I wanted to ensure that they would be technically feasible on the whole diaper, checking for the right alignment when doing up the pop studs and how easy/difficult it is to fasten and unfasten.

Stakeholder Feedback

'Unfastening is super easy you can just rip it off and no damage is done to the pop studs or the diaper material, it has a strong resistance and I don't feel like I have to treat it as a fragile thing where the pop studs could come off if I did it too hard' - Dad

'The pop studs do feel sturdy. I agree that this diaper meets technical feasibility, however, it looks rather small to me. Check the average size measurements for a 12-24-month-old's waist and leg circumference to ensure the measurements of your toile align with that, or even compare your toile measurements with the measurements you took of the [redacted] diaper and the [redacted] diaper. Also, make sure you can adjust for slightly smaller and slightly bigger babies as the 'average' is a very limited size. It would not be technically feasible for a diaper made for ages 12-24 months to not fit all babies 12-24 months so you need to make sure the elastic can stretch to accommodate bigger babies - as Pacifica babies tend to be bigger it would not be socially acceptable for this diaper, not to fit them.' - [redacted]

My Thinking

This stakeholder feedback makes me feel confident moving into my final prototype regarding the technical feasibility of my garment. If the pop studs were to fall off or make the client feel as if they weren't sturdy enough, then this would not meet technical feasibility requirements and it would not be socially acceptable to sell a diaper with faulty pop studs to the public. From this feedback, my thinking has also been informed to create a table with the average measurements of 12-24 month babies' leg circumference and waist circumference, in comparison to my toile measurements of waist and leg circumference, and [redacted] measurements to ensure my final outcome fits into these average measurements to ensure socially acceptable.

Average Measurements

Age	Average waist size	Average Thigh Circumference
12-24 months	49 - 52cm	23 cm

Diaper Brand	Waist size (unstretched to stretched)	Leg circumference (unstretched to stretched)
[redacted]	40-68cm	11.5-54cm
[redacted]	35-64cm	20-36cm
My diaper toile	42-50cm	7-24cm

My Thinking

From this table, I realised the size range of my toile would not be suitable and socially acceptable to sell as it doesn't meet the average waist size, and it only just meets the average thigh circumference. This would mean that a baby with measurements above average would not fit into the biggest stretch of my diaper, and that would not be socially acceptable. I realised I had printed the size in an A5 format instead of an A4 format so the pattern pieces were smaller than what they should've been. From this, my thinking has been informed to do a second toile with the correctly printed (bigger) pattern piece to see if those measurements are more suitable to my target audience's size range.

Toile 2



Front

Back

Above is a photo of my second toile done using the correct pattern piece printed in A4.

Stakeholder Feedback

‘This size looks a lot better than your first toile, and when you compare it to the [redacted] diaper or the [redacted] one they’re similar in size. Definitely take the measurements of this new toile as well and compare it to the baby averages to see if your size range will match.’ - [redacted]

My Thinking

From this feedback, my thinking has been informed to compare the measurements of my new toile with the average measurements for a 12-24-month-old baby.

Age	Average waist size	Average Thigh Circumference
12-24 months	49 - 52cm	23 cm

Diaper Brand	Waist size (unstretched to stretched)	Leg circumference (unstretched to stretched)
[redacted]	40-68cm	11.5-54cm
[redacted]	35-64cm	20-36cm
My diaper toile 1	42-50cm	7-24cm
My diaper toile 2 (bigger)	47-55cm	24-32cm

My Thinking

From this table, I can see that my second toile is much more suitable to the average size range of a 12-24-month-old baby and that the elastic will stretch to fit the larger babies as well as be accommodating for the smaller babies with the pop studs, which meets social standards.

Stakeholder Feedback

‘It would also be good to broaden your trials and try it on multiple babies. For example, you could go into a kindergarten and see if you could try it on a range of ages and sizes of babies. You shouldn’t limit your project and only try it on one baby, but rather get more community feedback within your wider target market.’ - [redacted]

My Thinking

From this feedback, my thinking was informed to get in touch with one of my classmates, [REDACTED] because her mum works at a kindergarten, and I asked her if she could try my toile on a range of babies and give me feedback. Thankfully she agreed, and although due to social constraints, I wasn't able to get any photos of these babies with my toile as I needed special permission, [REDACTED] one of the daycare workers emailed me some feedback below.

Toile Feedback from Wider Community

Good afternoon [REDACTED]

I hope you're doing well. It's [REDACTED]

[REDACTED] has spoken to me about your project, and while I am unable to take photos of the children in their nappies, I can still provide some feedback.

From what I've seen, the nappy appears to be the right size for a child aged 12-24 months wouldn't recommend going any smaller, as that could potentially cut off circulation around the baby's legs. You might want to consider removing the third set of where you will be sticking the pop-studs. You want to make sure that the nappy is comfortable for the child but otherwise, it's a good nappy and I would choose to put this on a baby.

Please let me know if you have any other questions or need further clarification.

Kind regards,
[REDACTED]

My Thinking

[REDACTED] feedback confirmed to me that my nappy was fit for my size range of 12-24 months. Although she suggested removing the tightest adjustment of pop studs from my nappies as none of the babies at the daycare needed such a small size, I am going to keep it in to ensure my diaper is also suitable for premature babies who may be smaller than average or even twins or non-singleton babies who tend to be smaller than average, my smallest pop stud adjustment could fit them. From this feedback, my thinking has been informed to start on my actual final prototype, using the pattern size I used for my second toile.

Dyeing Process



Final Prototype





Stakeholder Feedback

'It is a good fit for [redacted] and the adjustable size range of the pop studs allow Harper to use it as she grows bigger. We love how easy the diaper is to put on and take off, making the changing process a lot quicker. We also like how you can remove the insert pad to wash it separately and that it was nice and thick, providing suitable absorption. It is exciting to see a diaper that doesn't have any harsh chemicals without sacrificing the same functionality and aesthetics as a normal everyday diaper.' - [redacted]

My Thinking

From this stakeholder feedback and from my test in situ, my thinking has been informed that my diapers are fit for purpose for the intended environment of home during playtime/tummy time.

Final Evaluation

Considerations of the Outcome's Technical and Social Acceptability

As seen from the positive stakeholder feedback above, my clients, [REDACTED] would actually want to use my diapers on [REDACTED]. While [REDACTED] are just one set of eco-conscious parents, I believe my outcome is suitable for my wider target market too. The removable, washable, inserts were a favourite for [REDACTED] and this feature ensures I am meeting social acceptability as my outcome does not require you to wash the outer shell after each use, meaning you can reuse that shell with a new clean insert whilst the other one is in the wash. My target market of eco-conscious parents would also be drawn to the organic aspect of my diapers. My diapers address the issue of toxic chemicals in disposable diapers disrupting the reproductive organs and increasing the likelihood of nappy rash as they are made from 100% natural cotton, both the inserts and the shell, and they are dyed pink naturally using the food waste of avocado skins and pips, ensuring no harsh chemicals are coming into close contact with the baby's sex organs. This meets the interest of my target market of parents who are concerned about the chemicals coming into contact with their baby's skin. You can see the unique tint of natural dye on my diapers straight away which would draw in my target audience with these earthy tones and intrigue them into purchasing my product. The unique feature of adjustable sizing was also a positive aspect for my clients and it is technically feasible as it allows for a quick removal and installation of the diapers, making the changing process easier for parents, and socially acceptable to sell on a wider scale. Not only do the pop studs provide a quicker changing process, but they also allow for a range of sizes within 12-24 months, meaning you would not have to buy a new shell for at least a year as you can adjust the size of the diapers as your baby grows. This is appropriate for my target market as it encourages anti-consumerist habits by not having to constantly buy or replace the diapers.

Sustainability of Resources and Practise Used

The design features of my outcome address sustainability by enhancing the diaper's lifecycle. A typical disposable diaper has an average life cycle of one use or 2-3 hours. This diaper is then disposed of and ends up in a landfill where after 500 years, it will break down and end its journey, but not before emitting greenhouse gases, polluting our air and our waterways. My cloth diaper tackles this issue of sustainability because it can be washed and reused. My diaper can be changed continuously without having to throw away anything. The inserts get washed and reused, whilst the outer shell remains clean and ready for use. This allows for my diapers to have a much longer life cycle of just one use, it can be washed and reused until the fabric starts to deteriorate after many washes. It's not only the removable, washable inserts that increase the diaper's lifecycle but also the pop studs. The 4 different positions of my pop studs allow for adjustable sizing between 12-24 months old, meaning you can adjust the size of the nappy as the baby grows, allowing at least a year before the outer shell gets thrown away. Even when your baby does grow, and needs a bigger size range of outer shell, the reusable inserts can still be used on the new-sized outer shell.



Thankfully, when the outer shell is thrown away, it will not take 500 years for this nappy to break down in a landfill, but rather, in a week to 5 months the cotton materials would have soaked back down into the earth, and instead of polluting the soil, they will provide food for the bugs and increases healthy bacteria and fungus in the soil. These diapers were made naturally from cotton plants, and at the end of their life, they will give back to the same soil they came from, repeating the loop of regeneration. This concept aligns with the Maori worldview of Kaitiakitanga, to protect and give back to the environment that has provided for you. While I have made sustainably conscious choices throughout my work as much as possible, the one component of my diapers that will not break down is the plastic pop studs. I had to sacrifice the full breakdown of my outcome in order to incorporate adjustable sizing. This is something that I can strive to do

better on in future production, by using pop studs made from natural materials like wood.

Ethical Nature of Testing Practices

Because I dyed my own fabric using natural avocado dyes made by myself, I prevented the ethical concern of chemical dye sweatshops. Fast fashion retailers outsource to low-income countries where workers have minimal rights and get paid very little to dye their garments for less at a lower cost. These workers work long hours, in unsafe buildings inhaling the toxic chemicals used in the dyeing factories including formaldehyde which is highly carcinogenic for a small amount of money. Not only is this dyeing process unethical, but it also leads to further environmental damage. Because these low-income countries don't have the same regulations and restrictions as first-world countries, they don't properly dispose of the waste from the factories, and the chemicals from the dyes end up in the local waterways. Textile dyeing is the world's second-largest water polluter. This water pollution doesn't just affect the local waterways, once the hazardous dyes enter an ecosystem they don't break down, instead, they are spread around the globe to other waterways via the water cycle endangering both our marine species and human health. By choosing fabrics that are natural and not previously dyed and dyeing it myself, I am helping make a difference within unfair labour practices and unsustainable disposal of factory waste.

Health and Safety

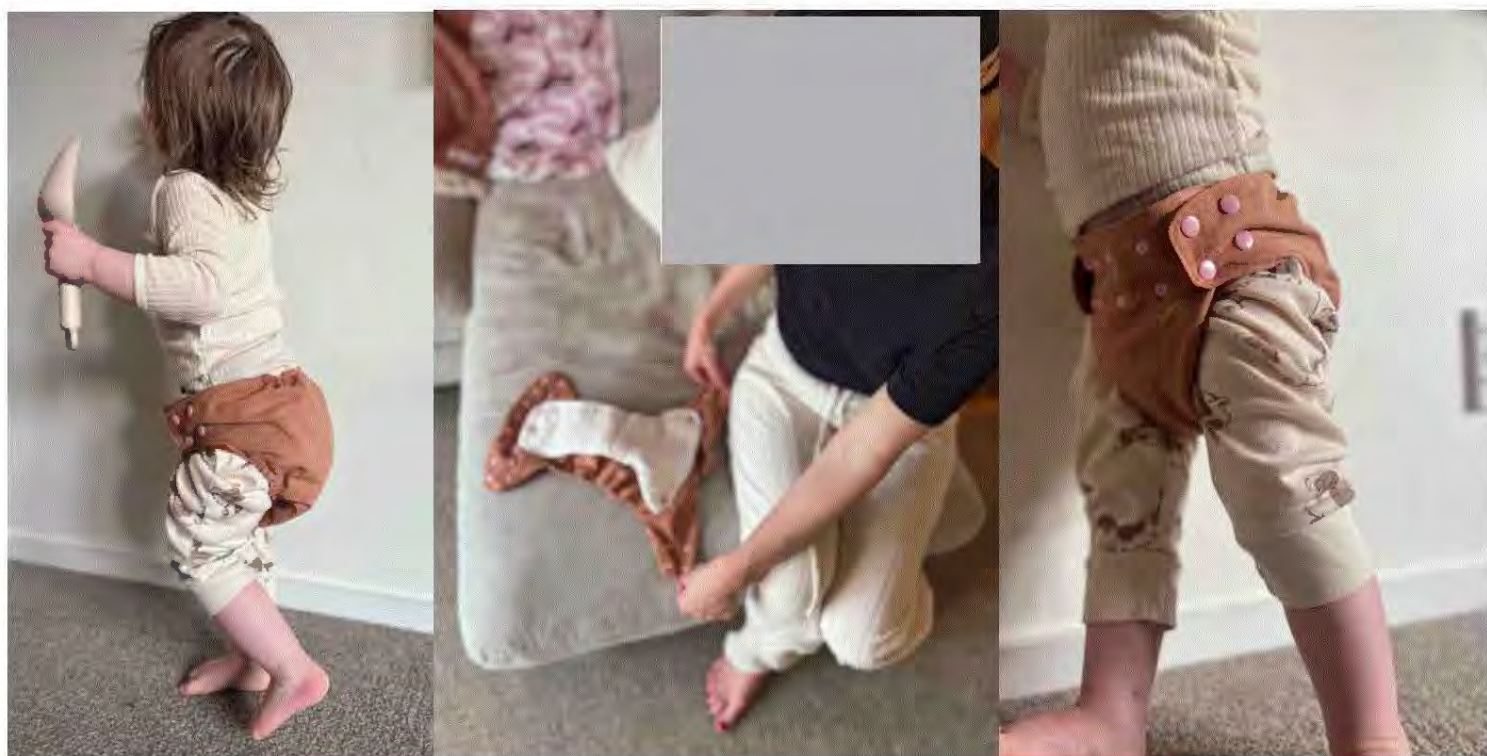
I have protected the health and safety of the users of my garment (babies) by choosing cotton, a natural material. Whilst synthetic materials like polyester and nylon are highly flammable, cotton is less dangerous as it doesn't catch on fire easily and it never sticks to the body when burning. Polyester, on the other hand, melts onto the skin causing further burn injuries. Because the users of my product are babies, it is especially important to keep in mind the flammability of materials considering that if they do catch on fire, babies don't have the adequate knowledge to react, putting them at a high risk. By using cotton material, I have minimised this risk and ensured social acceptability by not using a synthetic material like polyester which is banned on most children's nightwear, and that parents avoid buying.

Conclusion

Through functional and tech modelling I have been able to provide an outcome that fills the need for a diaper that is made from natural materials, dyed with natural dyes, has adjustable sizing and is reusable/washable. Working alongside my clients [REDACTED] I have met their specifications and considerations for my project and overall they loved the diapers and they would use them on [REDACTED]. Stakeholder feedback from the wider community of parents makes me feel confident that if I were to go into mass production of these diapers, that I would attract my target audience. Linking back to Kaitiakitanga principles, I feel confident that I have incorporated sustainable practices into my outcome and related my project to SDG number 13 in the broadest sense. As a kaitiaki, I was called to design something that would give back to earth, and that is what I have achieved through my diapers.

Louise using the Avocado Dyed Final Prototype Diaper - Harper wearing the diaper at home

(Please note the pants are only worn for safety reasons around photographing children)



Scholarship

Subject: Technology

Standard: 93601

Total score: 16

	Score	Marker commentary
Synthesis and integration	06	This project developed an outcome for the authentic issue of creating a diaper made from natural materials. The final outcome was well designed, utilising a range of techniques to develop a diaper with a removable insert that was absorbent, made from natural materials, dyed with natural dyes, had adjustable sizing, and was reusable / washable. There was deliberate decision-making around the materials used and the techniques and processes employed during development. Authentic stakeholder involvement enabled effective decision making. The outcome produced clearly met the brief requirements, with these featuring in the commentary throughout the project. There was evidence of ongoing testing and evaluation throughout. The diaper was tested in-situ by stakeholders. The technological practice utilised, and the outcome produced, demonstrates some elegant synthesis of knowledge, skills, ideas, and methods to drive and complete the project.
Justification	05	Evidence of systematic development. Markers were confidently able to see the process and understand why decisions were made. Stakeholders were vital to the development process. Because they were genuinely invested in the outcome, their feedback was ongoing, authentic, and meaningful and was reflected in the outcome. Throughout the process, clear next steps and improvements were identified. Analysis throughout the report was relevant and purposeful. There is evidence of functional modelling, including relevant testing and evaluation of techniques / processes / materials / mockups that have enabled informed decisions during project development. Both subjective and objective tests were explained and utilised appropriately, and as a result of this testing, markers felt confident that the outcome was going to be realised in due process. The report that was generated was made with the end user requirements in mind. It was easy to access and interpret. Feedback was sought from stakeholders, which justified its fitness for purpose in the broadest sense.
Critical reflection	05	The report demonstrated a clear narrative from start to finish. The candidate demonstrated reflection on key decisions throughout.

		There was consistent, clear evidence of the candidate's thinking about the process and outcome. There is a reasonable level of relevant reflection and evaluation evident throughout that was always clear. This enabled the candidate to make informed and reasoned decisions, modifications, and adaptations during development as issues arose. At the end of the project, the candidate reflected on the outcome's overall success. The markers were able to understand why the candidate was making the decisions they made. There was evidence that candidate reflection informed their decision-making and subsequent selection of materials and techniques. The result was a reusable diaper that is made from natural materials, is functional, and ready to be used.
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