

No part of the candidate evidence in this exemplar material may be presented in an external assessment for the New Zealand Scholarship award.

93601



S

## SCHOLARSHIP EXEMPLAR



NEW ZEALAND QUALIFICATIONS AUTHORITY  
MANA TOHU MĀTAURANGA O AOTEAROA

QUALIFY FOR THE FUTURE WORLD  
KIA NOHO TAKATŪ KI TŌ ĀMUA AO!

### Scholarship 2021 Technology

## Contents page

Contents page	1
Issue and in-depth exploration of the context	3
Issue	3
Client	3
What it means to be blind vs. low vision	4
Low vision	4
Total blindness	4
Deafblind	4
Challenges faced by blind and low vision people in everyday life, particularly in schooling	5
Universal design	5
Common design attributes that are limiting for blind people	6
Design attributes that might be included to make a textile outcome more accessible or interesting to the visually impaired	6
Texture	7
Contrast	7
Incorporating the principles of universal design	7
Braille	7
Initial meeting with the client (1)	8
The authentic issue and decided outcome	8
Key considerations	9
Addressing how a design can be adapted to better suit a blind person	9
Physical location	10
Social environment	11
Stakeholders	11
Main stakeholder	11
Wider stakeholder	11
Initial brief	11
Conceptual statements	11
Fitness for purpose in the broadest sense - key factors	12
Investigation of pre-existing products	13
Pre-existing mats	13
Pre-existing toys and noise sources for attachment	14
From BLENNZ	14
From other sources	16
Things I can carry over to my design from this investigation	16
Design concepts and development	17

Concept for the playmat	17
Concepts for the toys	18
Prototype construction	19
Stakeholder consultation (2)	21
Evaluating my construction processes	22
Developing ergonomics	22
Developing other elements of the toy designs	23
Pull-apart toy	23
Attaching the toys to the mat	23
Product safety standards	24
“Same but different”	24
<b>Final designs</b>	<b>25</b>
Mat	25
Stakeholder consultation (3)	26
<b>Material selection and testing suitability</b>	<b>26</b>
Final materials and the cost of the project	28
<b>Trialling key construction techniques</b>	<b>29</b>
Embroidery	29
Applying the shapes	29
Reflection on trials	31
<b>Construction</b>	<b>31</b>
Impact of the COVID-19 lockdown (17 August-7 September) on my project	32
Reflection on construction process	32
<b>Final products</b>	<b>32</b>
Testing the final products with a child	32
Incorporation of universal design in the final products	34
Final products	35
Final products in an example of their intended physical environment	38
<b>Evaluation</b>	<b>39</b>
Reflecting products against original specifications	39
Final meeting with the stakeholder (4)	39
Product life cycles and maintenance	40
Disposal of product	41
Reflection on final evaluation	42
<b>Letter from BLENZ</b>	<b>43</b>
<b>References</b>	<b>44</b>

## **Issue and in-depth exploration of the context**

### ***Issue***

In order for the project's context to allow me to develop a good scholarship report, it had to involve social elements along with textile knowledge and ability. The final outcome needed to be fit for purpose in the broadest sense, and for this to happen there needed to be authenticity. I had not worked with a client other than myself very much, but this project required one to provide that authenticity.

I read the 2019 Assessment Report for Technology Scholarship on NZQA to identify areas in the project that needed focus. I knew it was important to investigate all areas of my design context, like social and physical environments. I needed to receive ongoing feedback from my client and stakeholders to inform the design, and reflect on the processes I was undertaking and develop the project in a logical and organic manner. I also needed to ensure I was testing and trialling materials and processes to determine their suitability to make sure they were fit for purpose in the broadest sense. It was important to me that the design was sustainable, so I wanted that to be a main focus in my project.

### ***Client***

The client for my project was the Blind and Low Vision Education Network NZ (BLENNZ). They have a number of centres that serve as schools and provide resources that specifically cater to the needs of blind and low vision students that may not be accessible in public schools. According to their website, their mission is as follows:

"To enable learners who are blind, deafblind or have low vision to reach their full potential, BLENNZ provides quality education and specialist teaching services in partnership with whānau, educators and the wider community."

- BLENNZ website, "Our Vision"

I specifically worked with their [REDACTED] Visual Resource Centre, located in [REDACTED], as it is their centre that services my local area and is naturally the most accessible to me, as well as providing me with multiple opportunities to meet with the client and adjust my design to meet their needs.

The BLENNZ curriculum, known as the "Expanded Core Curriculum" is a version of the regular curriculum, enabling the students to participate in schooling while being supported with the education of independence and skills as a blind person. It covers

extra topics on top of the regular curriculum, including communication (braille), sensory efficiency, physical abilities, developmental orientation and mobility, social skills, life skills, assistive technology and career and future planning. BLENNZ works with people of many ages, right from birth to age 21, often keeping in touch even after a student no longer attends their centres.

### ***What it means to be blind vs. low vision***

Blindness is a spectrum. The term “blind” includes a wide range of people with a wide range of visual impairments. There are different types of blindness that change what people can see or visually interpret. “Legally blind” is a term more typically used to describe whether someone applies for aid or benefits, rather than being used as a descriptor of what they can or cannot see. People who are legally blind have a vision of 20/200 or worse, generally meaning they have to be within 20 feet of something to see it when someone with perfect vision could see it 200 feet away. If people have been blind from birth, they are considered “congenitally blind”, and if they lost their vision during the course of their life they are “adventitiously blind”.

#### *Low vision*

“Low vision” is a term used to refer to permanently damaged vision that cannot be corrected with methods such as lenses or surgery. People with low vision may still be able to interpret light, colour or shapes, or be able to see well enough to carry out everyday tasks. Low vision can be caused by a number of diseases such as glaucoma (damage to the optic nerve) or cataracts (clouded lens).

#### *Total blindness*

“Total blindness” is a term used to refer to people who have no vision and no light perception (NLP). Total blindness can be caused by injury or a more end-stage version of diseases like glaucoma.

#### *Deafblind*

People who have permanent hearing loss alongside permanent visual impairment are referred to as deafblind. They may have varying amounts of visual and hearing loss depending on the individual. According to a World Federation of the Deafblind report published in 2018, approximately 0.2% of the world’s population lives with severe deafblindness.

### ***Challenges faced by blind and low vision people in everyday life, particularly in schooling***

Blind people often have to find their own way of doing everyday tasks, since the world is so heavily designed for people with good vision. One of the main issues is naturally navigation, as getting around buildings and across roads is easier when you can see. This is typically overcome with canes, guide dogs or echolocation (whether passive or active echolocation). Blind people will often have things in specific locations so they know where to find it, as they cannot look for missing objects unless they feel around for it. This means that it is important that sighted people don't move things around without voicing that they are doing so. They also have to deal with societal stigma and individuals assuming they are helpless and need assistance with menial tasks.

In a more education-based context, issues that must be overcome typically relate to accessing information. Textbooks are often not published in braille, posters are often flat and have no tactile communication, and screen-readers aren't necessarily advanced enough to find specific pieces of information on a webpage quickly. Even if signs have braille writing on them, the blind person has to either be told there is a sign there or feel around for the sign in order to interpret the information printed. Navigation would also be difficult in a typical public school as spaces are crowded, noisy and often have wide open corridors and classrooms with many obstacles.

### ***Universal design***

Universal design is a term and concept coined by American architect and designer Ronald Mace. He was a strong advocate for people with disabilities, being wheelchair-confined himself, and worked over the course of his career to make designs more accessible and accommodating. In a 2012 book by Edward Steinfeld and Jordana Maisel, universal design is defined as "the design of products and environments to be usable by all people, to the greatest extent possible, without the need for adaptation or specialized design." Universal design is also known as barrier-free design and relates largely to the design principle of accessibility.

Ronald Mace and a team of his wrote the "seven principles of universal design" in 1997. They are intended to provide a framework for evaluating whether a project is usable, even for those with disabilities. The principles are as follows:

1. **Equitable use** - meaning the design is useful to people regardless of ability, and the means of use are identical for all users.

2. **Flexibility in use** - meaning the design is accommodating for a range of preferences and ability, like left handedness or right handedness, and provides adaptability where necessary.
3. **Simple and intuitive use** - meaning it is easy to understand how to use the design, regardless of knowledge, language, etc, and eliminates unnecessary complexity.
4. **Perceptible information** - meaning information is communicated effectively to the user, accounting for sensory abilities and ambient conditions (where necessary providing information pictorially and tangibly, as well as differentiating elements clearly so specific verbal instructions can be provided).
5. **Tolerance for error** - meaning hazards are minimized and full warnings are provided where necessary.
6. **Low physical effort** - meaning the design can be efficiently used without tiring out the user and allows the user to maintain a neutral position.
7. **Size and space for approach and use** - meaning the design gives enough space for use, accommodating for variations in posture, size and mobility, and important attributes are in reach from sitting and standing positions.

It is also important to note that accessible design and universal design are not identical concepts. "Accessible design" focuses specifically on creating outcomes for those with disabilities and may have specialized features to accommodate. "Universal design" focuses on providing for the entire spectrum of human abilities and aims to minimize adaptations required for different users.

#### *Common design attributes that are limiting for blind people*

There are a number of things about how we design products, webpages, buildings and other things that cause limitations on how they can be accessed by blind people. In products, round objects can cause problems as they may not stay in the location they're placed in and might instead roll off tabletops. This includes products like glue sticks, certain pens and tubed lipsticks. Bottles and packaging also usually don't feature tactile communication like braille or simply raised letters and symbols, which makes it harder to differentiate between products.

#### ***Design attributes that might be included to make a textile outcome more accessible or interesting to the visually impaired***

I brainstormed a variety of ways that a blind or low vision person might find more interest in my design. While I used the principles of universal design where possible, I was more focused on accessible design as my project was being produced specifically so that blind people can use it and it is less important that it is also useful and usable for able-bodied people.

### *Texture*

Texture can be included in a textile design in a number of ways. Different fabrics and fibres have different textures. Woven cotton would feel very different to knitted wool. Fabrics that have distinct textures include fleeces, corduroys and ribbed fabrics, velvet, lace, fur and silk. Fabrics with simplistic textures can be given texture by manipulating them. I can add pleats, pintucks, gathers, shirring, topstitching and embroidery. Haberdashery and embellishments can also be incorporated, like zips, buttons, sequins or applique. I can create texture by using soft materials other than fabric. For example, I could use wool to crochet or do weaving. I can also include hard materials like wood or plastic, though they are mediums that I have not used much and are generally outside of my comfort zone.

### *Contrast*

Some people that fall under the low vision category may be able to interpret light, colour or shapes. If there is high contrast between colours in my design they may be able to see it better, to a certain extent. Texture can also be contrasted, like using two different fabrics for applique.

### *Incorporating the principles of universal design*

If my outcome requires instructions, those instructions must be conveyed through tactile methods so they can be interpreted. Each part of the design must be distinctive so that verbal instructions can be clear. It is important that hazards are minimized in my design, as it is harder to mitigate damage without a sense of vision.

### *Braille*

If the opportunity arises, I may be able to use braille within my design. Braille is a method of tactile communication developed by Louis Braille in the 1820s. It communicates letters by using rectangular blocks called cells, within which there are raised dots. These dots can be in one of six positions and depending on their combination represent different letters, numbers or symbols. To convey that a letter is capitalized, the preceding cell has only the bottom left dot raised. If a whole word is capitalized, as seen on the BLENNZ

A	B	C	D	E	F	G	H	I
⠠	⠨	⠠	⠠	⠠	⠠	⠠	⠠	⠠
J	K	L	M	N	O	P	Q	R
⠠	⠨	⠠	⠠	⠠	⠠	⠠	⠠	⠠
S	T	U	V	W	X	Y	Z	
⠠	⠨	⠠	⠠	⠠	⠠	⠠	⠠	



**BLENNZ**  
⠠⠠⠠⠠⠠⠠⠠⠠



website, it is preceded by two capital symbols.

Overall I think that I am most likely to utilise texture and contrast, as they are the most easily incorporated with soft materials, which are what I typically work with.

### **Initial meeting with the client (1)**

The initial meeting with my client (12/3/2021) was an opportunity for me to figure out a specific issue to address and an outcome within that. It was also an opportunity for me to address my lack of knowledge surrounding blindness and what it is like to live as a blind person. I also needed to investigate the school's environment to determine what I needed to consider in physical and social settings when developing my design.

### ***The authentic issue and decided outcome***

The issue that I have identified with my client is that low vision children between 6-18 months often take longer to develop gross and fine motor skills than sighted children. There is a need for a product that tackles this issue as there is not a wide variety of products designed specifically for low vision children in this age bracket and they are subsequently under supported during such a crucial development period. Based on the resources I received from BLENNZ - primarily Dr Nielsen's Functional Scheme - I have identified some key gross and fine motor skills my product must aim to develop. Between 6-18 months children are learning to roll over, crawl, sit and stand unsupported, and walk. They are also grasping and picking up objects using pincer and palmar grips, and putting things into boxes.

Some other key skills I can focus on are their auditory and tactile perception skills. As their visual perception is limited, it is important that they are trained to interpret things through their other senses. Typically, children will be comparing tactile qualities of different objects and localizing sounds. In my selected age bracket, children often use their mouths for tactile exploration so I had to consider this when selecting materials and constructing the product.

The possible products I could make in the textile field to tackle this issue included things that the babies could lie, sit and crawl on like playmats, rugs, or play arches, or things that would focus more on their fine motor skills like stuffed toys or mobiles. Based on the discussion with the client and the need to focus on both gross and fine motor skills my final outcome will be a playmat that varies in tactile characteristics and aims to encourage children to start crawling and moving around the mat. With this, I will construct a variety of toys that can be attached or removed from the mat. They will each have a purpose and may stimulate the child via sound or texture, or will encourage a

specific fine motor skill. The final part of my outcome is a pattern for the mat. This is so the mat can be reproduced by other people, meaning it will not be a one-off product. Having a pattern will make the mat replaceable when it reaches the end of its lifespan, and it can be published online so it can be accessed by other BLENNZ centres or organisations to expand the reach and benefit more young blind children.

Parts of the BLENNZ expanded core curriculum include communication (including concept development), sensory efficiency, physical efficiency and developmental orientation and mobility. These are all elements of the curriculum my products can be a learning tool within.

I also did some further research to confirm the authenticity of my issue by reading some academic papers based around the development of gross motor skills and the delay found in blind children. The studies show that there is a significant delay in the development of motor skills in blind children and that they require more support than a sighted child in the development of these skills. Through my research I can confirm that this is a significant issue that requires addressing, and that my product will benefit a number of children, particularly if it can be reproduced.

### ***Key considerations***

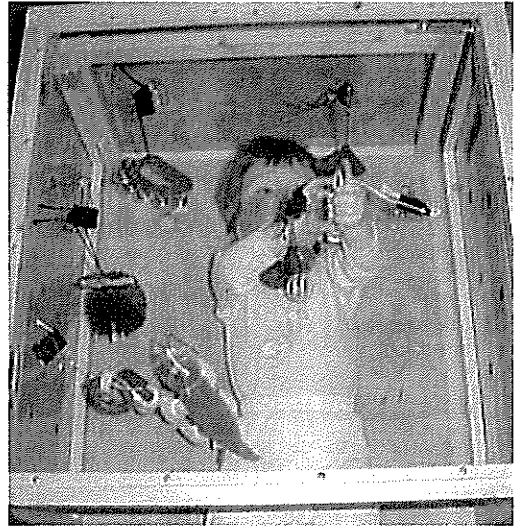
#### *Addressing how a design can be adapted to better suit a blind person*

While meeting with Diane it was stressed to me that most young children who are visually impaired are not totally blind but instead fall into the low vision category. Many of them are still able to interpret some colour and light. She told me that for these children, they find it easiest to differentiate between black and white, or red and yellow. Therefore, I will largely limit the colours of my design to these four as they will be most useful.

I also had to acknowledge that when blind children drop or throw their toys, that toy has basically disappeared for them as they can't see it to locate it. It was important that any toys used in the design were either permanently attached or could be attached and then removed. If possible, removable toys provided the mat with flexibility and it could be altered from child to child.

Noise is also a key factor when designing for blind people, as it becomes a more important sense since they focus on what they can hear. Incorporating noise into the blanket can help to train the child's ear and encourage their auditory perception skills, as well as provide them with another reason to move and explore the mat.

Lilli Nielsen was a psychologist who was well known for her work with blind people, particularly with children and those with multiple disabilities. She wrote many books on teaching and developing skills within the blind, especially motor skills. Much of her work was focused on an Active Learning Approach, which supports the idea that in order to learn, people must do things and become active participants in their own development. Some products that have been developed around this approach include the "Little Room", which is a box full of sensory equipment to stimulate the user who is placed inside (seen right). This product can help to develop gross motor skills - for example, a child started to kick as their feet were being stimulated by bells placed in the box. The HOPSA dress also helps to develop gross motor skills. Similar to a jolly jumper, the user can be placed in an upright position without forcing the legs to hold weight. Over time, the weight placed on the legs can increase and the user will learn to stand on their own.



"Environmental intervention can facilitate skill attainment through Active Learning equipment and techniques, including learning to move, coordinate hand movement [...] and play [...], promoting object conceptualization, object permanence, self-identification and spatial relations"

- *Early Learning Step By Step*, Lilli Nielsen

From Lilli Nielsen's work, I know that creating a product that stimulates a variety of senses is likely to have a positive impact on the lives of its users. I also know that the product should be able to be used, to an extent, unsupervised, to allow the children to gain some independence early on and play an active part in their own development.

#### *Physical location*

The mat is likely to be used either at the BLENNZ site itself or in the house of a young blind child. Therefore, the dimensions have to be a good size to fit on the floor in these locations. I do not have specific measurements for this, but will assume that dimensions similar to a playmat that can be purchased from elsewhere will be fine. It also has to be a good size for a baby to move around on. I also had to consider how the mat can be cared for (e.g. washability and mitigating sun damage) to ensure it lasts a long time so many children can benefit from it. While at the BLENNZ site, I was shown a cupboard

full of their “junk”, which was a variety of items that could be used to stimulate a blind child via touch or sound, like tinsel and beads. If possible, I wanted to find a way some of these items could be attached to the mat to provide another use for them.

### *Social environment*

There are two main factors of the social environment that need to be considered. The first is the condition of the users, meaning that I must take into account their disabilities and ensure the products are designed to develop their skills specifically. Total blindness is particularly uncommon in the given age group, so I can incorporate visual factors considering their limited vision perception of colour and light. The second factor is that the users are very young children, and there must be no hazard to them in the products. Ergonomically, the products have to be sized for the children and there must be no small parts as they could choke.

### **Stakeholders**

#### *Main stakeholder*

The main stakeholder for the mat and toys are the 6-18mos children, but as they cannot communicate needs and feedback on design ideas, I will have these conversations with [REDACTED], who I met with at BLENNZ during my initial meeting. [REDACTED] is the main stakeholder for the pattern, though instead of being a voice for children this will involve her own feedback and ideas.

#### *Wider stakeholder*

Other people who I have to consider in the design and may consult for feedback include parents of blind children, other BLENNZ staff, and people who may potentially purchase and create the mat using the pattern. I may also interact with sighted children and their parents, because despite the fact the mat is specifically designed for blind children, there is potential for it to be used by sighted children.

### **Initial brief**

The overall project consists of three outcomes; the mat, the toys and noisemakers and the pattern. I will develop these under three separate briefs.

### ***Conceptual statements***

The mat is designed in order to encourage the gross motor skills of 6-18mos babies who are blind. It must contain a variety of textures that contrast strongly to each other

for maximum tactile impact. The mat must have pockets or other attachment forms for the toys and the noisemakers to be incorporated.

The toys and noisemakers needed to be products that could be attached and removed from the blanket in order to make the mat a flexible activity. The purpose of the toys is to provide another incentive for the child to move around the mat, as well as encouraging both tactile and auditory perception. Interaction with the toys will also encourage fine motor skills and coordination.

The pattern will be designed so it can be sold digitally, so organisations overseas and in New Zealand can access it easily. It needs to be able to be printed off, in A4, and then attached together to create the full pattern. The purpose of the pattern is so the outcome is not a one-off product but can be reproduced either by myself or other people so a wider range of areas can reap the benefits.

### ***Fitness for purpose in the broadest sense - key factors***

#### **Mat**

- Sustainable and non-toxic materials.
- Durable and machine-washable materials.
- Varies in texture for tactile stimulation.
- Uses black/white and red/yellow contrast.
- Assists in the encouragement of gross motor skills.
- Ergonomically suitable.
- Has pockets or ties to attach toys.
- Edges are appropriately finished in all circumstances.
- Incorporates principles of universal design where possible.

#### **Toys**

- Sustainable and non-toxic materials.
- Durable and machine-washable materials.
- Varies in texture for tactile stimulation.
  - Note: the tactile elements of the toys is a primary sense, whereas any auditory elements are a secondary sense as not all BLENNZ students have good auditory perception (i.e. the deafblind students).
- Uses black/white and red/yellow contrast.
- Every toy has a purpose, either to assist in the development of fine motor skills or to stimulate the child and encourage auditory and tactile perception.
- Ergonomically suitable.
- Safe to enter a child's mouth.
- Constructed so they can be attached and removed to the mat at will.

- Meet pre-existing toy safety regulations.
- Incorporates principles of universal design where possible.

#### Pattern

- Digital format for distribution.
- Can be printed on A4 paper.
- Economised layout for minimal paper usage.
- Concise, clear instructions.

### Investigation of pre-existing products

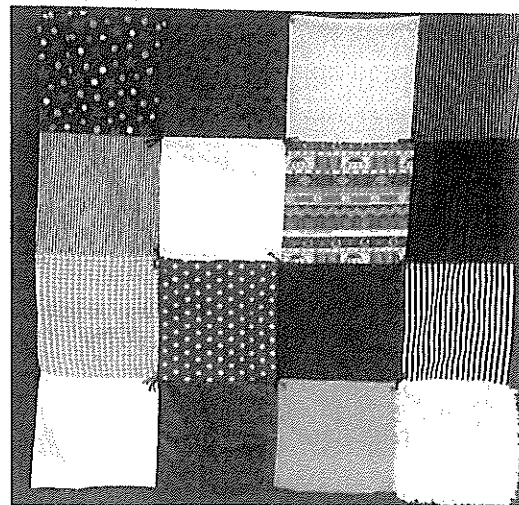
To help me design my own sensory playmat, I needed to investigate products that already exist to gauge what does and does not work in a design. Because my playmat consists of the mat itself but also a variety of toys that can be attached and removed from the design, I evaluated different mats as well as different toys. At my initial client meeting, they had a few products for me to look at to generate ideas, so I assessed these, as well as products that I sourced elsewhere, like the internet or from friends with young children. As the product is designed to keep blind children developing at the same level as sighted children, I did not limit this investigation to products specifically created for blind children, but assessed them based on my criteria which were for such products.

#### *Pre-existing mats*

I chose to only analyse the mats I was shown at BLENNZ as these were specifically designed and constructed for usage by visually impaired children. I felt that mats I had sourced elsewhere would not provide helpful information as they did not have the same tactile and visual qualities that were necessary to make the design successful.

The first mat I was shown was a grid of different textures and colours. The purpose of the mat was to encourage gross motor skill development and the texture contrast was necessary to encourage movement.

Some of the fabrics included in the mat were plain cotton weaves, fake fur, felt, challis and fleece.



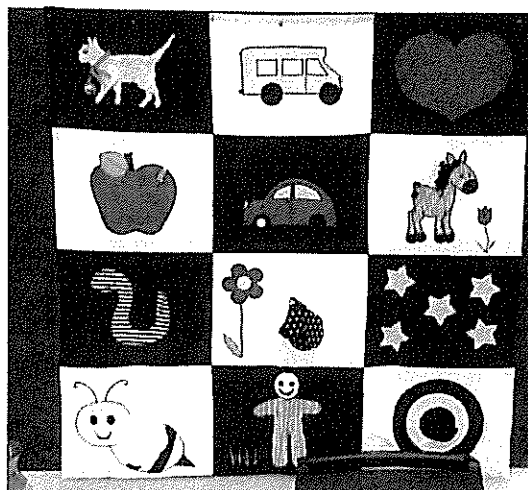
Pros: The mat did include some black/white and red/yellow colour contrast. It had appropriate dimensions (roughly 1.2mx1.2m) and was constructed with durable and machine washable materials.

Cons: The variety of colours included in the design would result in a less impactful visual appearance as there was less contrast. The patterns that were printed on many of the fabrics were too intricate and would appear blurry to someone with low vision. The texture contrast was also minimal as similar fabrics were often placed directly next to each other (plain cotton weave squares next to other plain cotton weave squares). This mat doesn't clearly encourage gross motor skills as the uniformity doesn't provide a clear path of encouraged movement.

The second mat I was shown again had a grid structure, but instead of being constructed with a variety of materials it was primarily a felt-like fabric. To create varied texture the mat had different symbols applied to the front of each section.

Pros: Black/white and red/yellow contrast was a primary feature of the mat. The applique created some texture contrast as there were different levels to the fabric. A similar design could be utilised to teach children to differentiate between certain symbols tangibly as they cannot see them. A bell was stitched into the cat collar which incorporated noise. It was also constructed from durable and machine-washable materials and had appropriate dimensions (roughly 1.2mx1.2m). [redacted] expressed that this mat was a better fit for the BLENNZ environment and better met their needs than the first mat.

Cons: There is much less tactile variation as the entire mat was made of very similar textures. While the applique provides some variation, it is not nearly as impactful as fabrics with different properties contrasted. Like the first mat, this doesn't clearly encourage gross motor skills as it is very uniform, whereas forming a trail of some sort may suggest to the child that there is a path they may follow.



### ***Pre-existing toys and noise sources for attachment***

#### *From BLENNZ*

During my initial meeting, [redacted] also showed me some sensory vests they use with the young children, and a variety of toys.

The sensory vests were designed to be draped over the child's body, had various toys and textures incorporated. This particular vest had a teething toy (a simple wooden ring), ribbons, buttons, clips, tassels, beads and the top half of a sock (the bottom half had been used in another product due to the rubber grip on the underside creating an interesting texture). It was primarily constructed from woven cottons.

Pros: The teething toy that was incorporated had a purpose beyond sensory stimulation as children typically teethe between 6-12 months (part of my age bracket). The various products created many different textures and were often an outlet for minimizing waste (like using old buttons or the other part of the sock). The materials were also durable and largely machine washable.

Cons: The harmonious palette of the colours would have little impact on the children as there was very minimal contrast. The patterns on the fabric were also quite intricate, again wasting an opportunity for contrast. Some of the beads that are attached are also quite small, and could be a choking risk should they become detached from the mat.



The other toys I was shown included some small stuffed animals with squeakers inside, and some pouches with different objects (buttons, packing peanuts, bean bag stuffing) in them to create texture and sound. They were made from woven cottons in various colours and patterns.

Pros: Noise pouches could be tucked into pockets or velcroed to the front of my mat, incorporating another incentive for the child to move around the mat. Stuffed animals can be used as functional toys outside of the mat setting, and could be tied on or tucked into pockets.

I can also point out to users that pre-existing toys of the child's can possibly be used in the mat as well, if it is designed to house toys. The materials are durable and the pouches themselves are washable.

Cons: The contents of the pouches are not always machine washable. The intricate patterns on the fabrics become blurry for low vision children.





### *From other sources*

I researched a few toys online marketed towards 6-18mos children to investigate what they were aiming to develop within the children's skills, and how I could develop those skills in my own designs.

- Toys that can come apart and be put back together are good for developing a child's fine motor skills, but if I was to incorporate them in my design I would have to tackle the issue that the child cannot see the pieces. While pulling toys apart may be entertaining, if the child drops the pieces they disappear to them, and if the toys cannot be rebuilt it largely defeats the purpose.
- Cause and effect toys like rattles or buttons that cause light or noise are a good learning tool for children. Cause and effect is an important real-world concept that needs to be taught as it becomes particularly relevant when teaching independence. While independence is not important between 6-18mos as even sighted children are incredibly reliant on adults during this period, cause and effect knowledge often helps when teaching children to keep themselves safe (e.g. if you touch the hot stove, it will hurt).
- Board books and cloth books are good for children between 6-18mos as they are more durable and can handle being put in a mouth. A cloth book could be used to introduce more tactile elements or could be used to train finger sensitivity from a young age, which is helpful if the child is introduced to braille later on.

### ***Things I can carry over to my design from this investigation***

From my investigation of the mats, I knew that it was important to utilise contrast to create a higher impact on the senses, both in texture and in colour. Creating colour contrast would be easy and I could ensure my selected fabrics are bold and in the appropriate colours. Texture contrast was harder as plain woven fabrics are the easiest to source and the least expensive - but I could manipulate those fabrics via embroidery, pintucks, and other methods to create contrast even between fabrics with similar properties and structure.

From my investigation of the toys, I discovered that there are a variety of ways to create noise within a design without having to use squeakers. Putting different things in a pouch like buttons can create rattling sounds as well as a different texture. However, if I incorporated noise or texture pouches I had to ensure they could be cleaned to an extent as I did not want the children putting grubby toys in their mouths. I could also incorporate toys that have functions aside from sensory stimulation like teething toys, which are particularly appropriate for my age bracket. I also identified colour and pattern contrast as a main problem within the pre-existing toys at BLENNZ. Bold patterns and high contrast colours are equally important in the toys as they are in the mat.

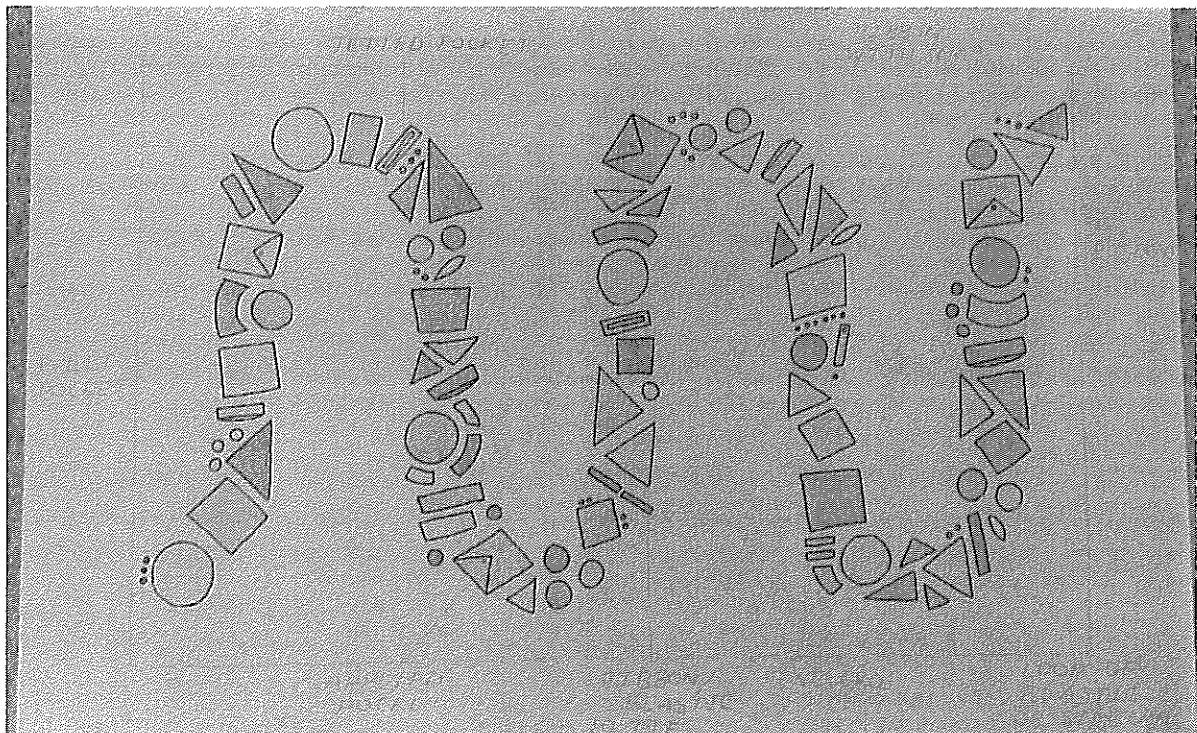
I also recognised that there was a high opportunity for upcycling pre-existing materials and scraps within my products, and that my design could be more sustainable by utilising this instead of purchasing brand new, as long as the materials were still suitable. Using second-hand or otherwise easily accessed materials also meant that the overall cost of the production decreased, and meant that when the products are replicated it does not become an expensive process.

## **Design concepts and development**

### ***Concept for the playmat***

Important physical features of the mat include pockets and ties of varying sizes, and the “trail” element to encourage exploration. The texture variation and colour contrast will come from the materials used in the mat. I brainstormed a number of ways that the toys could be attached to the mat, and briefly evaluated the benefits and disadvantages of geometric and organic shapes, both within the trail itself and the applied shapes within the mat.

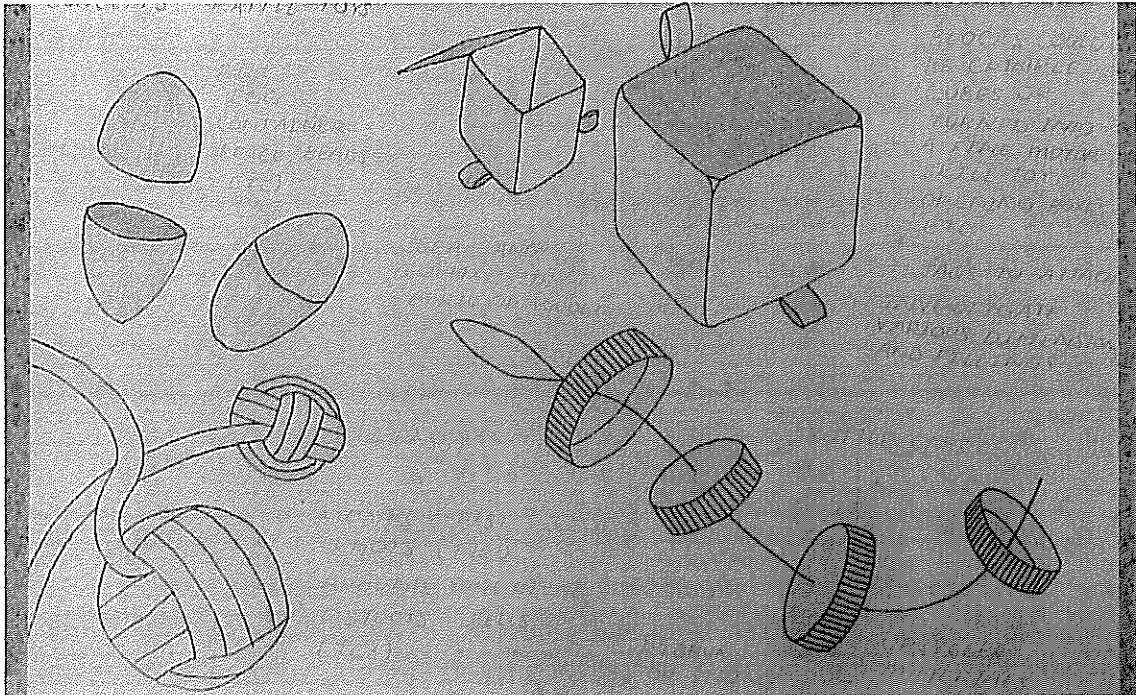
I produced one concept for the mat featuring a variety of my brainstormed elements. I did not want to waste time producing several concepts without ensuring I was on the right track for what the stakeholders wanted within the product.



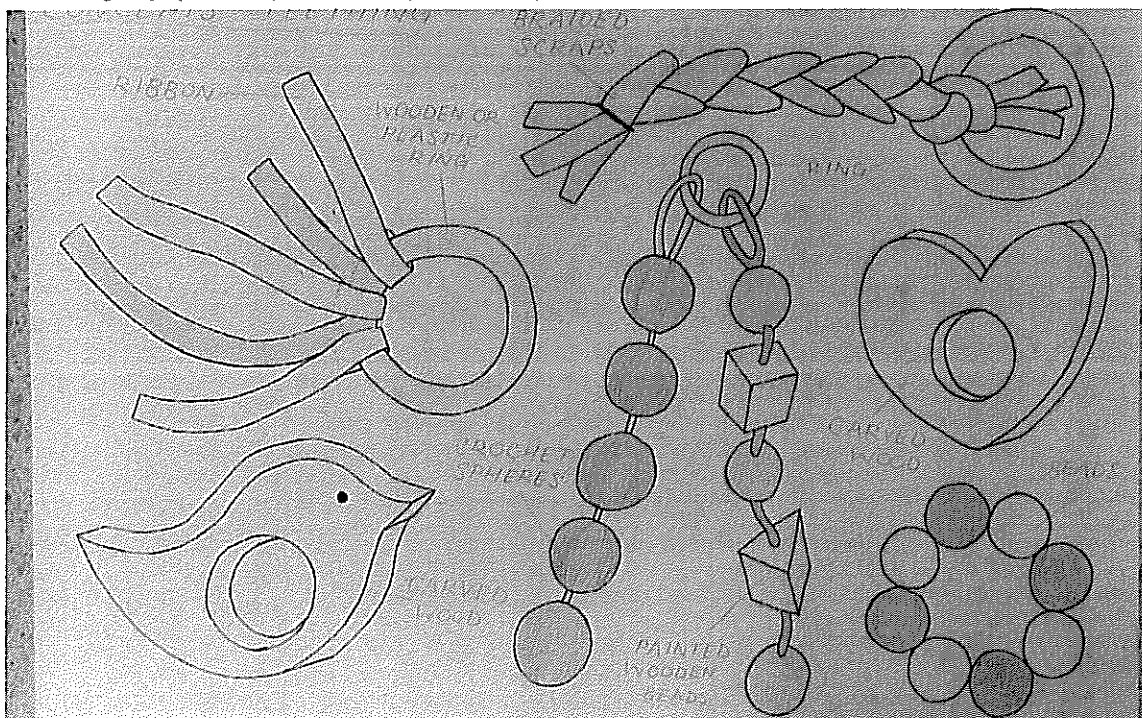
## Concepts for the toys

I divided the toys into three categories and produced concepts for each:

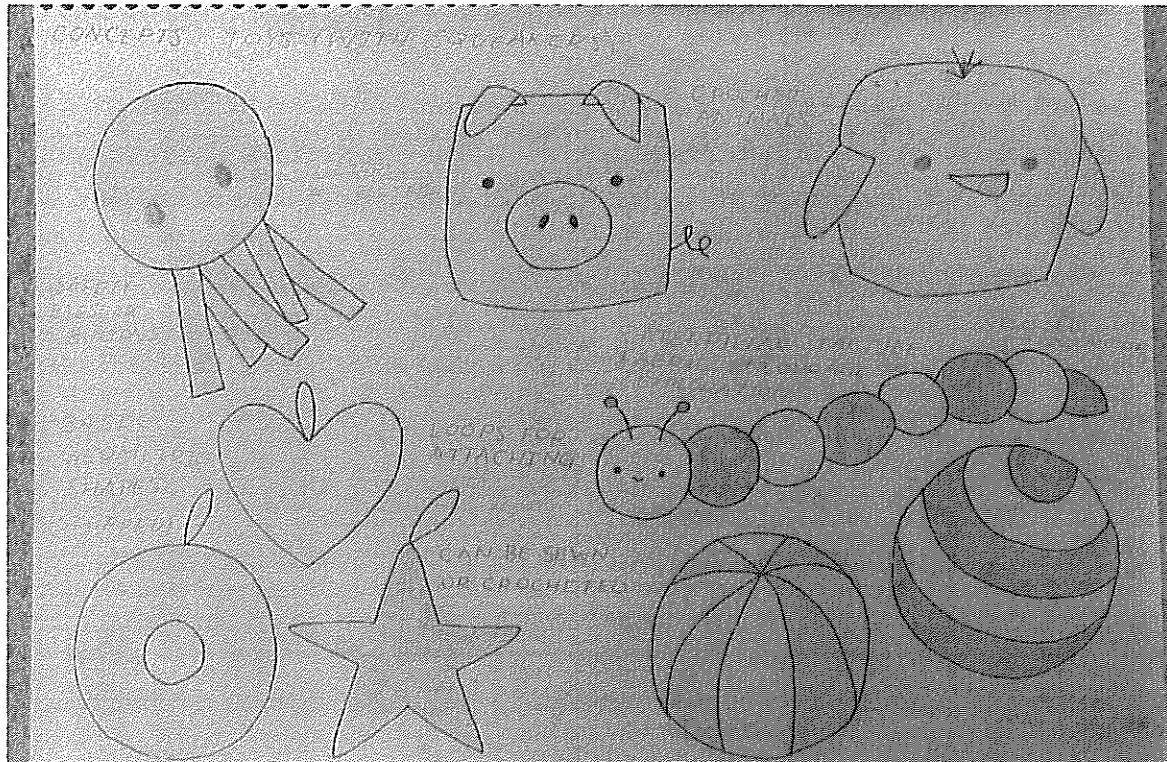
Rattles (auditory stimulation and perception, grasping encouragement)



Teething toy (eases pain during teething)



### Squeakers (auditory stimulation and perception, grasping encouragement)



### **Prototype construction**

After I had designed a number of concepts, I created a few prototypes so that I had a physical representation of my designs, and I could better identify faults and things that could be improved. I could get more specific feedback on physical toys and samples than on designs alone, so I completed these before getting another stakeholder consultation. Prototypes also allowed me to test different textures, further investigate appropriate dimensions for the mat and toys, determine their ergonomic suitability and most efficient construction practices.

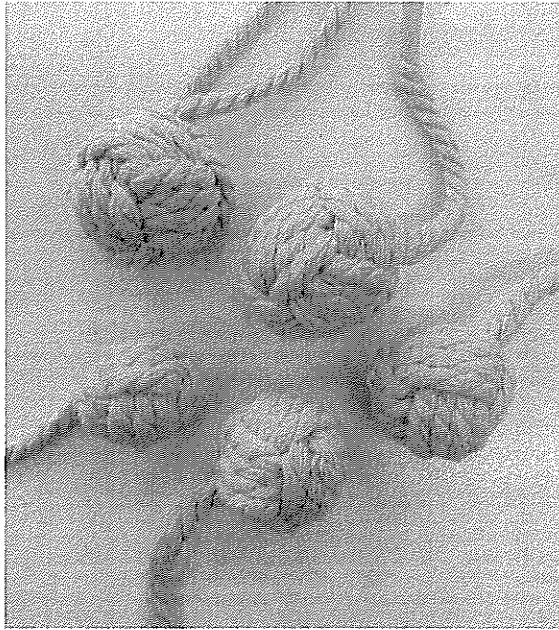
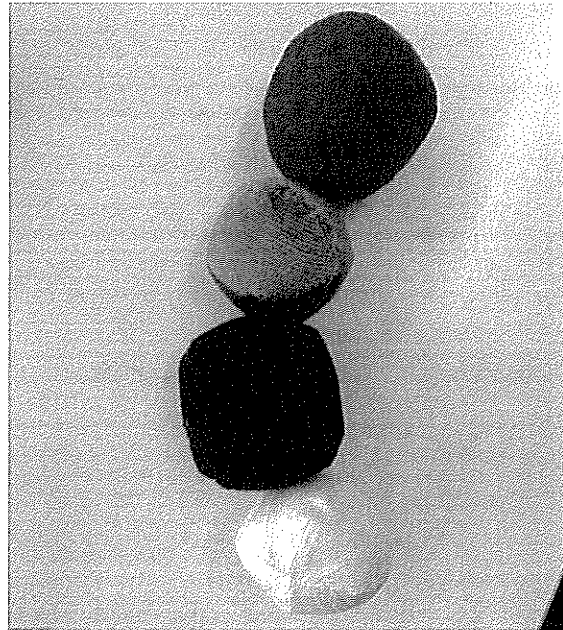
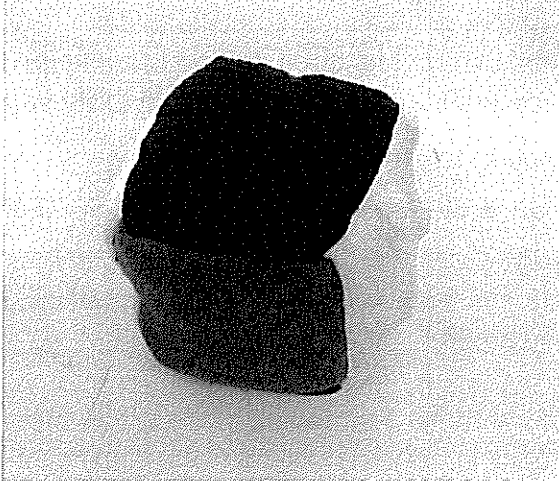
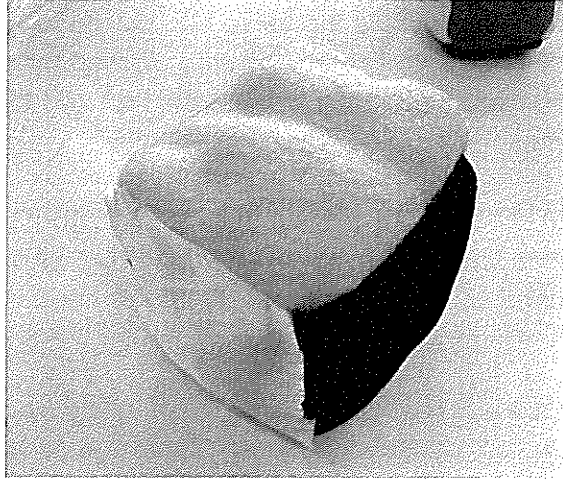
In order for my project to be fit for purpose in the broadest sense, it was important that I was sustainable in both my materials and my practices. When constructing prototypes, I used either scrap materials from other projects that would otherwise be thrown away, or materials that could be recycled for the final outcome.

I felt that it would not be a sustainable decision to make a prototype of the whole mat design, especially without receiving any feedback initially as it would use a significant amount of material that could not necessarily be reused and I wanted to ensure my design was on the right track before I invested time and materials into any prototype.



Instead, I tested some different embroidery techniques to give texture to standard woven fabric and created samples of various tactile crochet stitches.

I picked a couple of toys from my design pages to create prototypes of. None of the toys were completely perfect designs as they were just mock-ups to give a visual idea of the design work, so some had elements left out in order to prevent waste. The prototypes that I constructed were as follows:

	
<p>Monkey fists</p>	<p>Caterpillar</p>
	
<p>Fabric block one</p>	<p>Fabric block two</p>

## ***Stakeholder consultation (2)***

I decided to undergo another consultation before undertaking any significant developments to ensure the work I had completed was on the right track, and then I could use feedback I was given to develop the designs as per the stakeholder needs. I took my prototypes and samples with me as well as my sketchbook.

The main feedback I was given on my mat was that it would be helpful to have a defined raised edge or lip on the edges. This would alert the baby using it that when they reach that point it is the end of the play area. It would help them to learn boundaries and define spaces, and would also help them find the play mat again if they managed to come off of it. This lip did not have to be large, a sort of cord or piping would most likely work, but I did have to consider the impact it may have on the washability of the mat.

■■■■ also recommended that I consider how the mat would be stored - whether it would be rolled around something, folded, or stored in another manner.

Generally the toys received positive feedback. I found out that the toys could also be used to help with concept development if there were two similar designs - e.g. the wooden ring is a circle, but this ring is also a circle, just bigger/made of a different material. It could help to define different shapes and forms for the children, meaning instead of constructing a series of completely different toys I could have a few variations on some. We also discussed whether pull-apart toys were a viable option, and whether my caterpillar design could be velcroed together. Pull apart toys are hugely helpful in teaching fine motor skills, but it was reiterated that the pieces still had to be attached together somehow, as if the child dropped the pieces they would struggle to put them back together. I also needed to ensure I knew exactly how each toy would be attached to the mat.

■■■■ was very happy with the crochet samples, as they were a completely different texture to the fabrics I had used in my other mockups. She suggested I also try using different weights and textures of yarn to create more tactile variation. The embroidery was also good, but the shapes I stitch would be more impactful if they were larger. She also stipulated that I could find textures beyond just soft materials, as wood, metal and plastics could also be used in my toy designs.

She also suggested I investigate some different ways of creating more noise in my designs. The rice and bells used within the monkey fist knots were good, as well as the bottle cap rattle, but she also suggested sand and beads.

### ***Evaluating my construction processes***

While constructing my prototypes I took notes of elements that worked within the construction process and elements that did not work. I wanted to ensure that my practices were efficient and best economised my time and materials.

One of the main elements I wanted to do differently was cutting my materials. I cut each piece separately with scissors, which often caused slight inconsistencies within the shapes. This caused problems particularly for the cubes and the spheres in the caterpillar. Instead, I wanted to try using a rotary cutter and cutting several fabrics at once.

I also wanted to increase the durability of my products by making sure seams were strong. My blind stitches were particularly weak when closing objects as it was a new skill I was learning. I found it was difficult to make the stitches straight and even as I was also concentrating on making sure the raw edges stayed on the inside. To improve this, I needed to iron the hems on the edges I would be blind stitching before I sewed the rest of the object together. The joins between the spheres were also particularly weak, as I joined them after I had already sewed most of the spheres. I wanted to trial stitching the adjoining edges of each sphere together and then constructing the spheres around the pre-joined pieces.

### ***Developing ergonomics***

It was important to test the toys on a child in order to determine their ergonomic suitability. They had to be sized so that they were small enough to hold either with one hand or both hands, but also large enough that the child could not fit the whole thing in their mouths and potentially choke. I also wanted to see if there were certain toys that were preferred, and whether there were different reactions to the noises and textures.

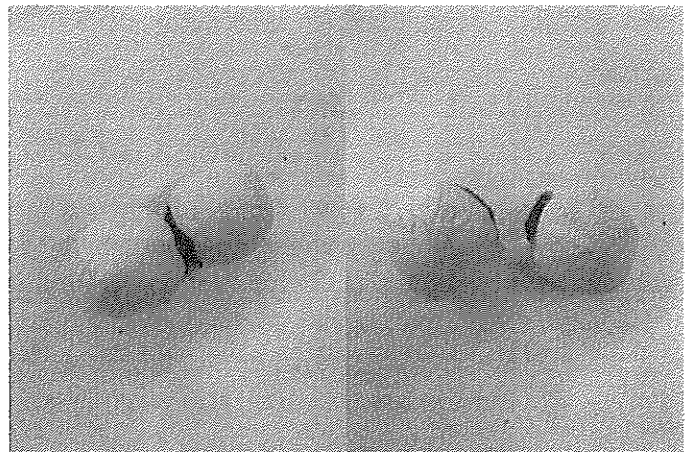
I took some of my samples to my neighbour's house to test them with [REDACTED] who, at time of writing, was 10 months old. He particularly liked the caterpillar mockup, as the spheres were a good size for him to grab and squish in his hands. He also liked shaking the monkey fists to trigger the bell or the rattling. While he was less interested in the blocks, I feel it may have been because they were not heavily stuffed, and were therefore less solid to hold in his hands. From this testing, I determined that when constructing my final toys it was important that they were dimensionally stable and held some shape, even if they could be squished. It also reinforced the importance of sound within the designs, as since a sighted child was attracted to the noise, a child without sight would be even more so.

For the dimensions of the mat itself, most mats marketed towards sighted children have sides of around 0.9m-1.2m. However, my mat has a different purpose than the mainstream playmats. Playmats for sighted children are aimed at giving a child a space to play and sit, whereas my mat is specifically designed to get children moving around. Therefore, I don't want the users to be confined to an overly small area that may restrict developing their movement, so my mat should be larger than the mainstream market. I settled on dimensions of 1.2mx2m (2.4m<sup>2</sup>), which gives the extra room for moving around while still being small enough to fit on an area of floor in the average home.

### ***Developing other elements of the toy designs***

#### *Pull-apart toy*

In order to create a pull apart toy, I had to figure out how to keep the pieces attached while still having the effect of them being pulled apart. To do this, I felt that incorporating elastic could be very effective, as it allows the pulled-apart pieces to be stretched which can further develop the fine motor skills of the children. However, elastic would not keep the pieces of the caterpillar flush against each other, which was how I wanted them to be, and it would also not provide the distinct motion of the pieces being separated. To balance out these needs, I formulated a design involving elastic and velcro, and then created a mockup to test whether it functioned how I wanted it to. I found that it worked very well, and I felt that I could make a full caterpillar from the method.



#### *Attaching the toys to the mat*

To attach the toys to the mat, there were four ways that I had considered - velcro, elastic, snaps and pockets. However, to increase the flexibility of the mat and to ensure the toys could be shuffled, I wanted each toy to be able to be attached at every point on the mat. This ruled out velcro and snaps as I didn't want to attach a snap and a piece of velcro to every toy. As long as the toys were not too large, they would all be able to at least partially fit into pockets on the mat, and this would also help the children with posting things and putting things into "boxes", which was one of the fine motor skills I was aiming to develop. If each toy featured a loop, it would be possible to tie a thread through the loop on the toy and a loop of elastic on the mat to attach them.



### ***Product safety standards***

As I wanted to produce a commercial pattern for my products so they could be replicated and distributed, it was important that they were as close to meeting the product safety standards as possible. I could not access the actual legislation as it was costly to access and outside of my project budget. Instead, I emailed a company that tests toys within New Zealand, however did not hear back from them. So, using the New Zealand Toy Distributors Association webpage discussing standards for toys designed for <36 months, I noted some key factors. Any elements I attached, like buttons, needed to be large to prevent choking and securely attached, which I could test by dropping the products or biting them. Stuffing needed to be securely within the toys, seams needed to be secure and any strings or elastic needed to be short to prevent strangulation. Less flammable materials were also desirable.

### ***“Same but different”***

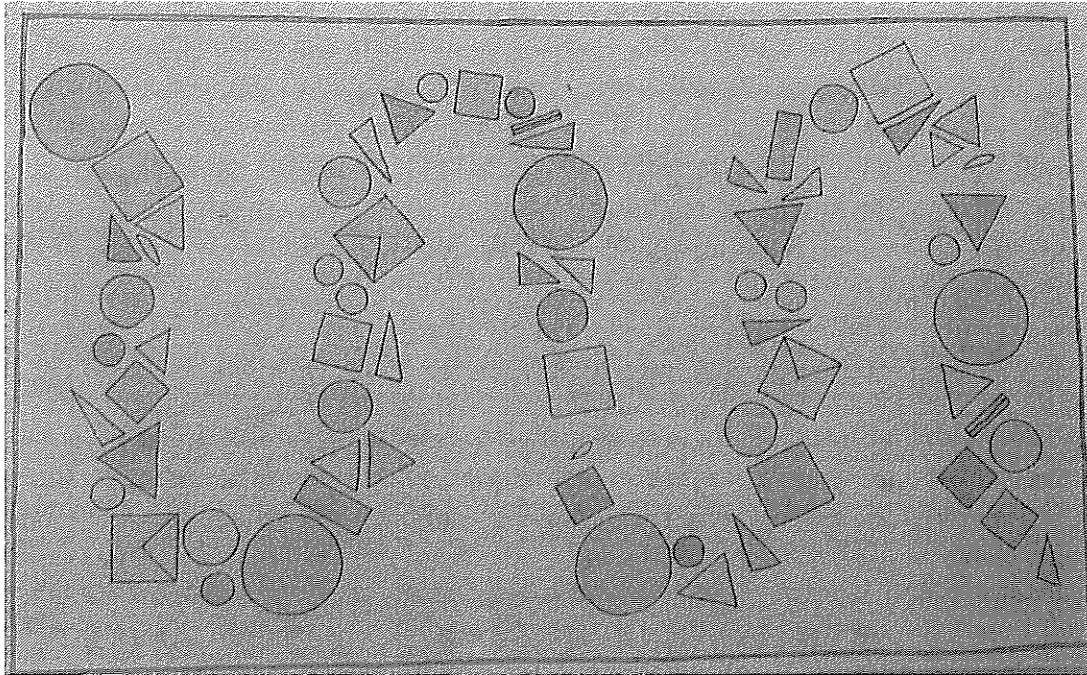
As I had discussed concept development with [REDACTED] at my last consultation, I selected toys based on the skills they aimed to develop, but also selected various “pairs” of toys - toys that were very similar but were slightly different in some aspects in order to push the “same but different” concept. I settled on a selection of 12 toys as follows:

- Two fabric blocks of different dimensions and a different number of ribbon tags. Some fabrics used on the blocks would be the same, and others would differ.
- Two wooden teething rings with different attachments, one with wooden beads and one with ribbon strips.
- Two caterpillars, one that detached with my velcro design, and the other with squeakers in certain sections. One was also black and white, and the other red and yellow.
- Two crochet balls, made of different wool textures to differentiate the balls. One was black and white, and the other red and yellow.
- One bottle cap rattle to introduce a completely different auditory element.
- Three monkey fists of varying dimensions, and with different bearings in the centre. One had a simple knot, one had an old lip balm container filled with birdseed, and one had a bell.

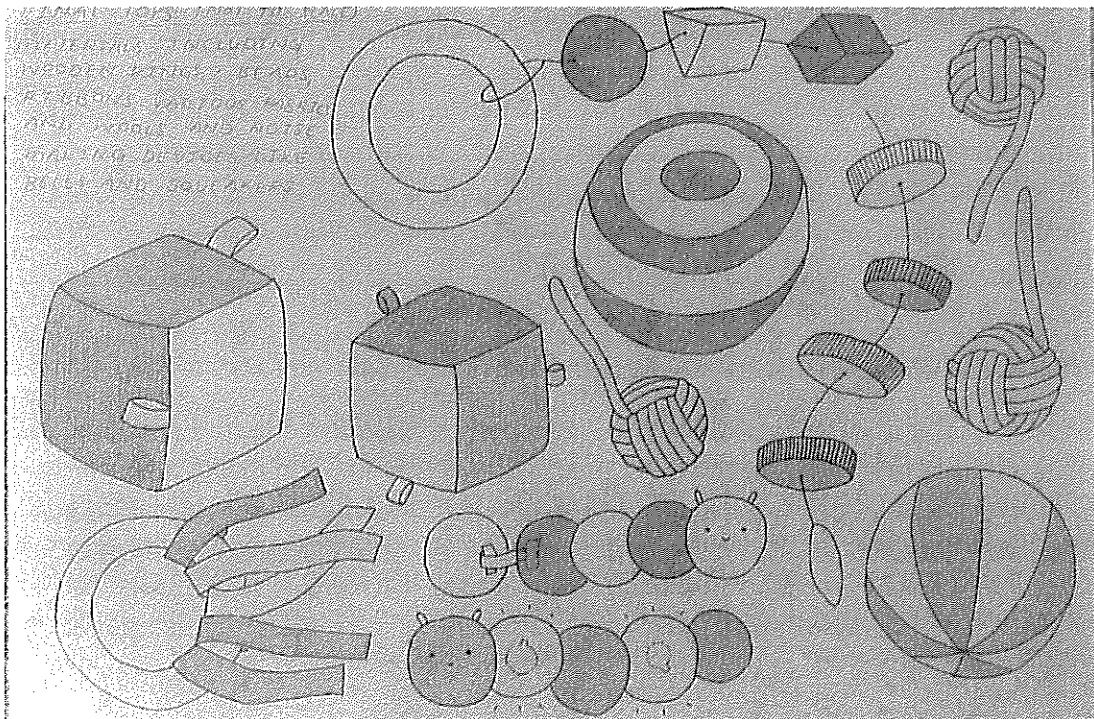
I also adjusted the mat design so that the shapes were limited to only circles, triangles and squares of different sizes.

## Final designs

### *Mat*



### *Toys*



### ***Stakeholder consultation (3)***

I held a meeting with [REDACTED] to seek approval on my finished designs to ensure there was an opportunity to address any final concerns she may have had. At this meeting, I also met with one of the early childhood teacher from BLENNZ, [REDACTED] who had been wanting to meet with me to see what my project was about as she was likely to help distribute the final products. I brought some of the prototypes that I had already brought to my second consultation so [REDACTED] could see and feel some of what I had created. I also brought samples of different defined edges and the prototype of the pull-apart caterpillar so that I could make a stakeholder-informed decision to ensure my final designs were fully suitable and met the brief. It was important to bring physical mockups instead of just drawings as much as possible as the texture and tactile qualities were vital elements of the final product. Both [REDACTED] and [REDACTED] felt that my designs would work well and were happy for me to start final construction. Of the three different defined edges I had trialled (all of which involved cotton rope threaded through a casing), they felt that having cotton rope threading through bias binding made for a clean and tactile edge. I also asked if it would be helpful if I designed and constructed a bag for the mat and the toys to store them, and also enable a convenient way to move them from place to place if the products are being moved between children. They said yes, so I noted that there was another element for me to develop.

I wanted to ensure that this consultation was informing for both myself and for my stakeholders. I had all the questions I needed to ask prepared in advance to ensure I didn't miss any important information. It was also important that my sketches were clear and that I had physical, tactile prototypes available for feedback as without them I would have been unable to receive good feedback on whether the ideas were fit for purpose. This consultation was very important as it determined whether my products were suitable for the need identified. However, my designs met all the specifications I had made based on other consultations and research so I felt confident that they would approve.

### **Material selection and testing suitability**

There were a number of specifications the materials I used within the mat and toys had to meet in order to be fit for purpose. All the softer toys and the mat itself had to be made of machine washable fabrics, and the harder toys (e.g. teething toys) needed to be made from materials that could be wiped down so everything could be kept clean. It is important that the products can be kept clean as they are likely to go into children's mouths, meaning they also have to be made from non-toxic materials. They needed to be durable and sustainable in order to create long-lasting products.

The textile industry is one of huge amounts of waste. Of the textiles created each year, 12% are wasted during cutting and manufacturing processes, 75% are sent to landfill by consumers, 12% are put back into the system by donating and recycling and <1% are regenerated into new fibres. As most parts of my design only needed minimal amounts of different fabrics, I saw an opportunity to use up some of my own scraps. It also provides the same opportunity to those replicating the mat, and does not necessarily require purchasing lots of new materials. The project is more sustainable when it prevents waste as much as possible, and using up existing fabrics is far more cost-effective than purchasing new, as the project requires so many different fabrics.

However, I had to balance the desire to use up old materials with the need for non-toxic, baby-safe fabrics and the need for tactile variety. I knew I would be purchasing fabric for the main part of the mat, as I did not have scraps large enough. This would also be the part of the mat the child would be sitting or lying on so it was important it was non-irritable. The toys were the most likely element of the project that would go in the child's mouth as they would be held, so it was also important the materials used within those were mouth safe. I felt that if I had to make small sacrifices on toxicity for the tactile elements of the mat, it would be alright as the child was unlikely to put sections of the mat in their mouth, and would likely not lie on a textured section for prolonged periods. I had also considered dying fabrics and painting wooden elements, so I had to check that the dyes, paints and sealants I used were all non-toxic and child-safe. Elements such as buttons and bells had to be large enough so they couldn't be choked on, and securely attached to withstand dropping and biting in order to meet the safety standards.

When choosing between using natural wool or acrylic for the crochet elements of the products, I considered a number of factors. Overall, wool is considered to be a more sustainable and eco-friendly material as it is a natural fibre and is biodegradable. However, acrylic is easier to wash in a machine and is less likely to get damaged, is more durable, won't shrink and is hypo-allergenic, making it suitable for children's products. Because of this, I have chosen to use acrylic instead, despite its detrimental environmental effects, as it will help the product to last longer and be disposed of less quickly. I was able to source red, yellow and black acrylic from the scraps at home.

Many fabrics are widely regarded as child-safe. Typically these fabrics are made from cotton, linen or polyester fibres, which are all very versatile and can be used singularly or blended to create a variety of fabrics. Popular fabrics for babies' products include lawn cotton, muslin, jersey knits, fleeces (including minky), terrycloth, corduroy, flannel and velveteen. For my own projects, I sourced small amounts of all these fabrics from

scrap buckets in my own home and from my classroom to test them on the specifications.

I cut samples from all the fabrics I had sourced and ran them through a cold water wash. All of the fabrics sustained no noticeable damage from the machine other than some fraying, due to the unfinished edges of the samples. I pulled on them with a decent amount of force to check their dimensional stability and that they wouldn't rip or stretch out. All of the fabrics held up well except for the felt, which easily stretched out of shape. However, I didn't want to leave the felt out of the final design as it has good texture, so to stabilise it I will use fusible interfacing on all my felt shapes. Overall, I feel that my fabrics are suitable for the final product.

### ***Final materials and the cost of the project***

The final materials I settled on were white cotton poplin for the mat surface, with scraps of poplin, corduroy, velvet, satin, for the tactile shapes. The mat also had wooden buttons, zippers, elastic, velcro, cotton embroidery thread wadding, cotton rope and bias binding incorporated, which did not inhibit the overall washability and they are all washable materials. I made the bias binding myself from black cotton poplin, and used the same fabric for the bag as the bag also had to be durable and sustainable (like the mat surface). The toys were made from a selection of fabrics from the mat (including fleece, poplin and corduroy) which could be machine washed, and the teething toys that included wooden rings could not be machine washed but were easily wiped down. I also had squares of bubble wrap that could be tucked into the mat pockets which I had sourced from packages delivered to my family.

Because many of the necessary materials can be sourced for free, the mat is a cost-effective product. Cotton poplin is also an accessible fabric easily found in most stores at a low price - the fabric I used was priced at \$10 a metre. While purchasing the poplin, I found that it was most readily available in rolls at length 1.08m, which was not wide enough for my defined dimensions. Therefore, so the fabric and the design work together better and people who recreate don't have to search hard for poplin available at the right length, I will shrink the width of my mat by 12cm and have the final dimensions be 1.08mx2m.

Totalling the costs of the poplin, as well as haberdashery, beads, and other products I sourced brand new, the mat cost \$76.18 to construct. Compared to other specialised products on the market, this was incredibly affordable and much cheaper to make. For example, sensory products designed for blind children from American Printing House like their Laptime and Lullabies Storybook (which features similar tactile properties and elements to develop fine motor skills) costs \$359, which is far more expensive, making

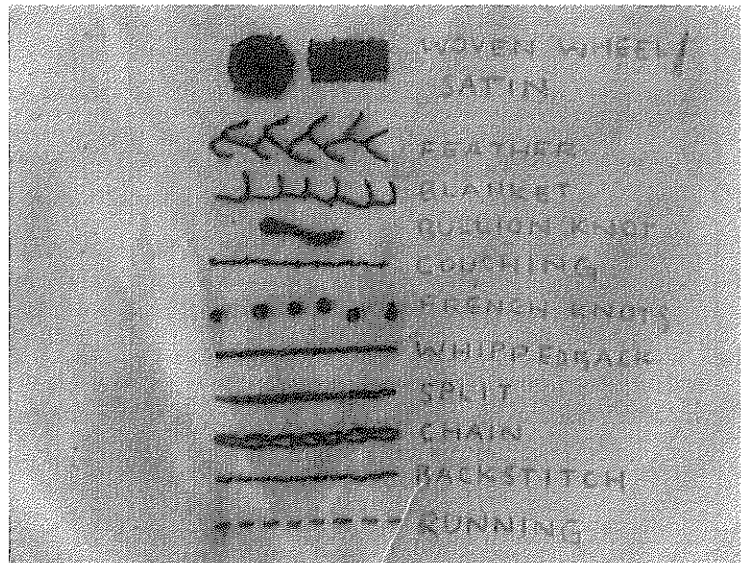
their products less accessible to people who may need it. The money someone may have spent on such products could instead be spent on materials to make their own, including sourcing the materials I found second-hand at a store, or paying the labour costs for someone to construct it. Therefore, I feel that the costs of my materials were fully justified, and the product was not overly expensive and could be replicated at a similar price.

### **Trialling key construction techniques**

I didn't want to waste time and resources constructing an entire prototype of the mat, so instead I trialled key techniques that would be involved. The main things I needed to figure out was which embroidery stitches I would use, and how the shapes would be applied to the mat.

#### ***Embroidery***

I trialled 12 different stitches - running stitch, backstitch, chain stitch, split stitch, whipped backstitch, couching stitch, feather stitch, blanket stitch, satin stitch, french knots, bullion knots and woven wheels. In order to best economise my time and materials I only did a small amount of each stitch.

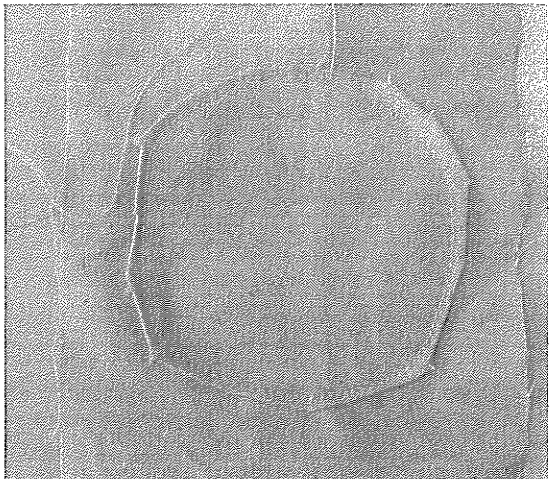
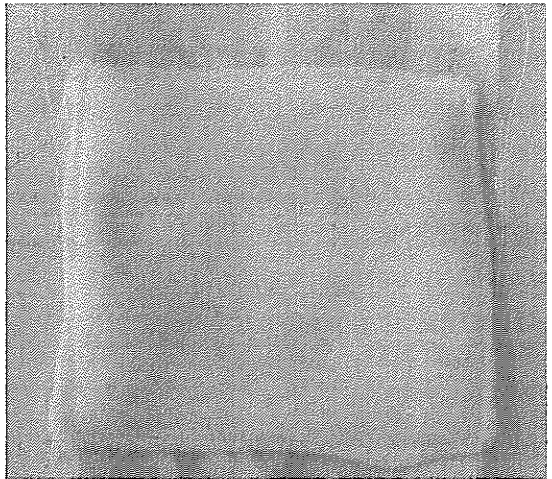


Of these stitches, I found that the feather stitch, french knots, bullion knots, satin stitch and woven wheels had the most tactile impact, based on my own opinion and those of my classmates. Most of these stitches, apart from the feather stitch, are fairly raised off the surface in comparison to more standard stitches such as running stitch. These stitches can also effectively cover a whole shape when used well. However, I found the bullion stitch difficult to do and feel that I can make do with only the other four. Therefore, when embroidering the shapes for my mat, I will use a combination of french knots, satin stitch, feather stitch and woven wheels.

#### ***Applying the shapes***

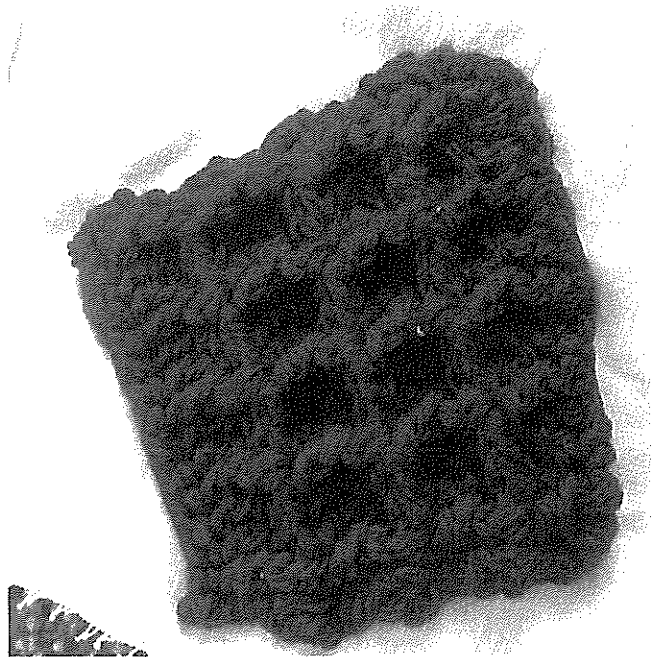
There are three main ways the shapes can be applied to the mat - machine applique, hand applique and reverse applique.

I found that machine applique is good for simple shapes that are not made from thick fabrics. As I finished the edges by folding them under, it created a lot of bulk when done with fleece and would do that with any thicker fabrics. Therefore, machine applique is best for thin fabrics, as long as care is taken when folding down the edges. I also learned that notching circles when folding the edges for machine applique could result in sharpish points, so when I complete the actual design I will baste and gather the edges instead.

 A black and white photograph showing a circular piece of woven fabric with its edges folded under, creating a smooth, finished look. The fabric is light-colored and has a visible weave pattern.	 A black and white photograph showing a rectangular piece of thick stretch fabric with its edges folded under. The fabric is light-colored and has a visible texture, possibly fleece or a similar thick material. The edges appear slightly bulkier than the woven fabric in the adjacent image.
Machine applique with woven fabric	Machine applique with thick stretch fabric



I trialled hand applique as a method for applying my crochet samples and found that it worked very well. I used a blanket stitch at the edges as it looked tidy and secured the sample well. Using hand applique to apply the crochet parts is best as the crochet can be too thick for the machine and the hand stitching is less noticeable and doesn't detract from the texture. In order to be sustainable I used a previous sample of my waffle stitch.



I found that reverse applique worked best to stitch thick fabrics as instead of having to fold the edges of the thicker fabric I could fold the edges of the thinner poplin overlayer. At first, I trialled stitching the fleece fabric without a jersey needle and it was messy on the back, so I unpicked it and trialled it again with a jersey needle which worked much better. Therefore whenever I do any applique with stretch fabrics on the machine I need to use a jersey needle.

<p>Reverse applique using thick stretch fabric</p>	<p>Reverse applique using woven fabric</p>



### ***Reflection on trials***

I feel that my trials on construction techniques have allowed me to make informed decisions going ahead into construction of the final product. I know which techniques work best with which materials and have successfully figured out how to manage all the different material properties in one product. It has also allowed me to learn new skills that I may be able to implement in future projects that I may complete.

### **Construction**

I planned out a construction process for myself and mapped out how long I thought things would take me. The tasks I included were cutting all my fabric, crocheting the necessary shapes, embroidering the shapes, sewing the reverse applique shapes, hand stitching any shapes, sewing the welt pockets, sewing the applied pockets, sewing some machine applique shapes, stitching buttons, basting the layers, sewing the last of the shapes, sewing and stitching the binding, and sewing the 12 toys. Then, I had to design and construct a bag for all the products that had a strap for carrying. I estimated that construction would take me all of term 3.

In order to economise my materials, I made sure to cut shapes on the edges of the scraps. Using scraps in general also allowed me to minimize the wastage involved in my project.

As I was completing construction, I made alterations to my designs. While I was crocheting the two balls with contrasting stripes, I found that the stripes were limiting the overall texture of the ball. As the tactile elements are more important than the visual contrast, I decided to just make two solid coloured balls of different textured yarn.

### ***Impact of the COVID-19 lockdown (17 August-7 September) on my project***

The COVID-19 level four lockdown went into effect right as I began construction on my final project. I was lucky to have some of the necessary materials with me in my home so I could make some progress, though it did set me behind schedule. I knew that it was important to do what I could on this project, and also to stay on top of my other subjects so I would be able to catch up on the parts of construction I wasn't able to do as soon as school reopened. I found it difficult to deal with the uncertainty, but was determined to finish the project.

### ***Reflection on construction process***

I found that many steps of my process took me a little longer than I anticipated. This, combined with the impacts of the lockdown and missing one week of school for a

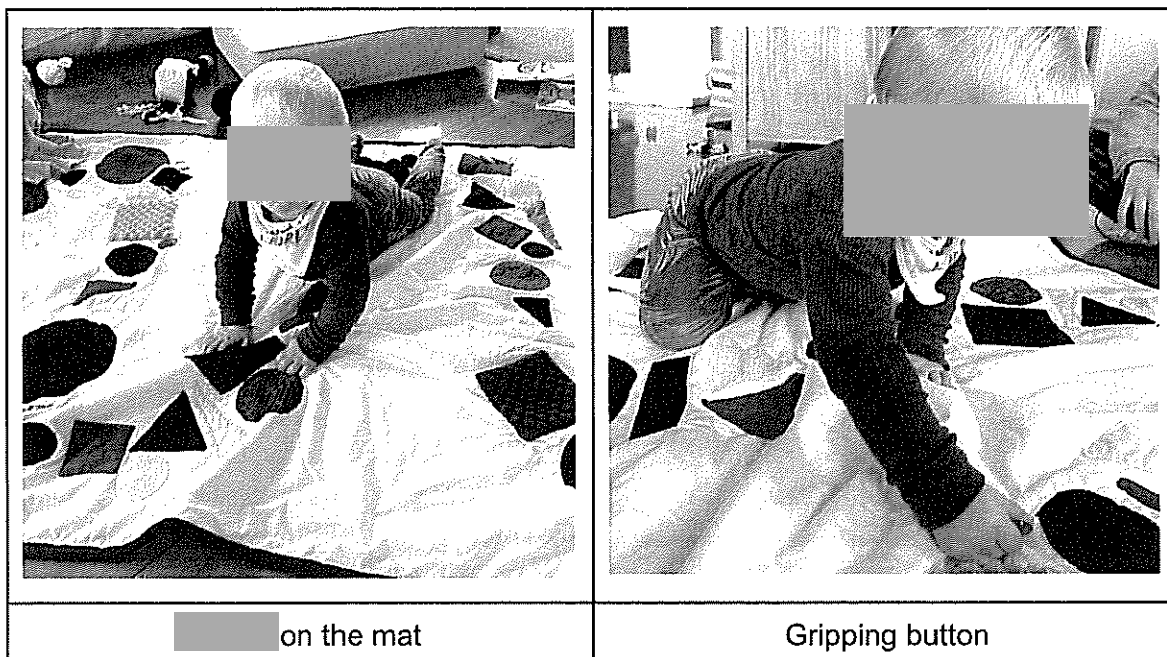
geography trip, made construction harder to complete than I had thought. I managed to finish construction by the end of week one, which was three weeks behind my original schedule. However, the deadline for scholarship had been pushed out by two weeks, so I only had one week less to evaluate and finish the report. I feel that my trialling enabled construction to go as smoothly as it could with the bumps in the road, as I knew how the processes worked and which meant that I was able to economise my time and efforts because I didn't have to unpick and redo things frequently.

## **Final products**

### ***Testing the final products with a child***

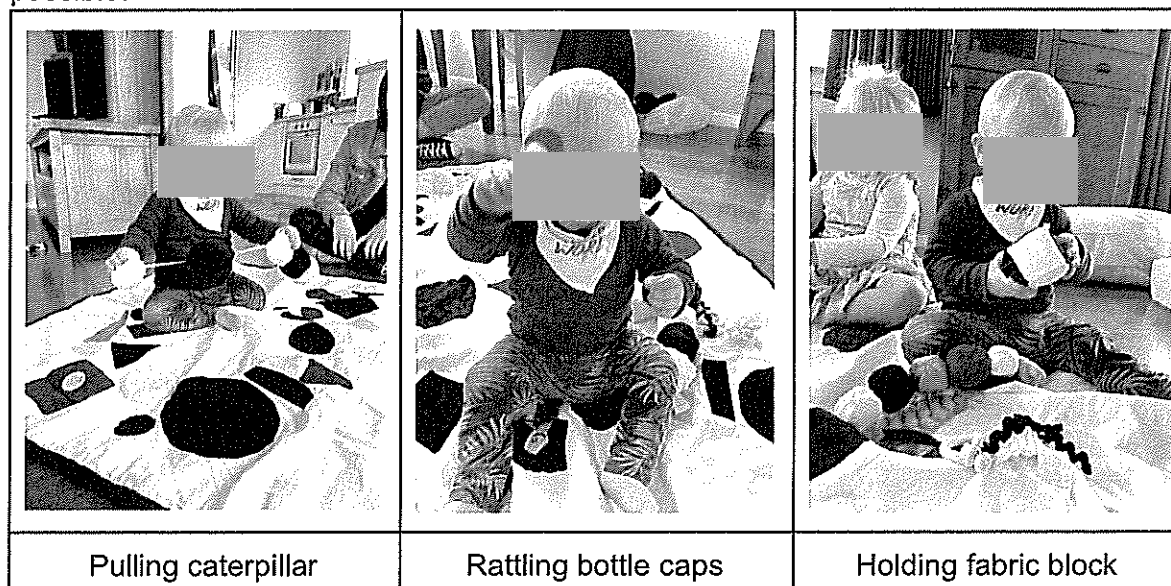
I returned to [REDACTED] who was now 15 months old, to test the final designs with a child in case I was not able to test them with the true client, a blind child. It allowed me to gain an understanding of how a child would react to and use the products. His sister [REDACTED] (3 ½ yrs), also partook in playtime with the mat. Their interest in the products lasted about 30 minutes, followed by including other toys they owned in combined play with my products for another 15 minutes. I felt that this was a good period of time for mildly supervised play that could allow a parent a short break or to finish chores or make a meal without having to entertain their child.

Some things that I observed in [REDACTED]'s interactions with the mat was that he had an obvious preference for certain fabrics and textures. He liked to grab the buttons on the surface with his hands and pulled at them (showing that my stitching was durable enough to withstand a child), and liked the sequined fabrics and bobble stitch squares. I also noticed that he mostly ignored the trail element in the mat, though I feel that he was inclined to move straight towards the fabrics he could see and liked. For example, he noticed a large circle made from the sequin fabric and beelined towards it, whereas a blind child would not do so and would be more likely to pay attention to the fabrics directly surrounding them and as such, follow the trail. He also interacted with the pockets and with help could undo the zippers ([REDACTED] could open and close the zippers and undo the buttonholes unassisted), which was good as it meant that it could later help blind children with skills that will help when fastening their own clothing or bags.



*Photos used with permission*

As for the toys, he liked to rattle the monkey fists and bottle caps and squish the fabric blocks and caterpillars. He was also able to pull apart the caterpillar on his own, and understood that pushing them back together would refasten them, but struggled with aligning the velcro. This affirmed to me that the pull-apart toy would be good for developing fine motor skills in the blind children as I had worried that the velcro and the spheres would be difficult to pull apart with little hands but 's ability proved it was possible.

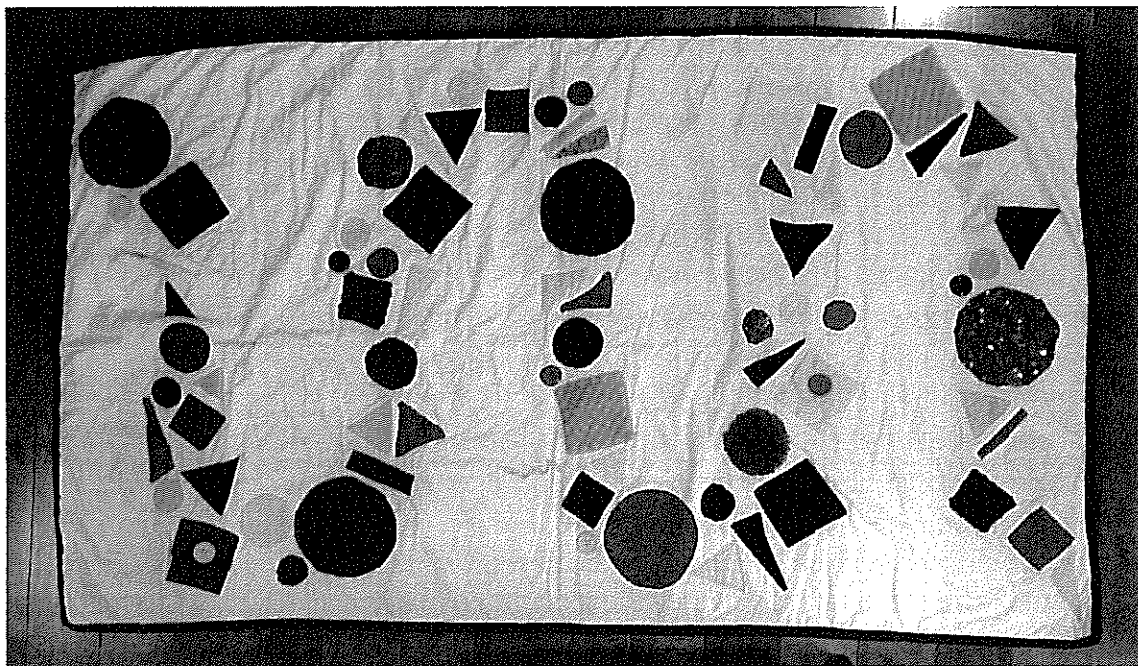


*Photos used with permission*

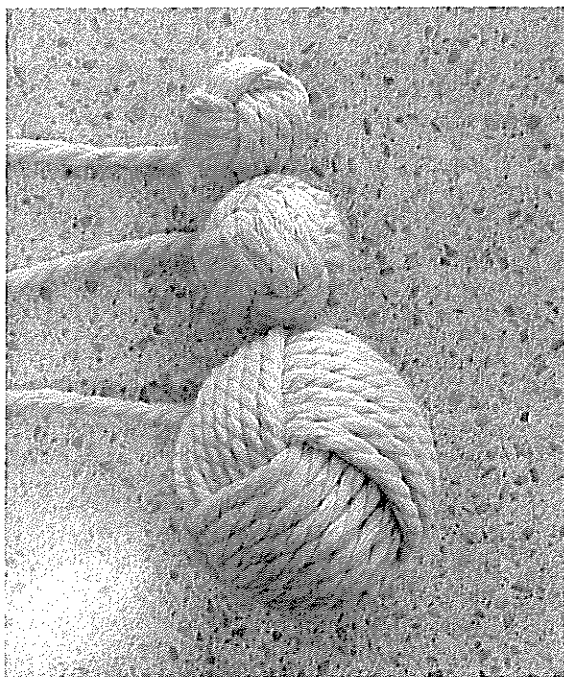
### ***Incorporation of universal design in the final products***

1. **Equitable use** - while the design has been specifically tailored to the needs of blind children, my testing and investigation with [REDACTED] proves that sighted children within the same age range can also use the product and can also develop skills through its use.
2. **Flexibility in use** - the design allows for toys to be swapped out depending on the preferences and needs of the user.
3. **Simple and intuitive use** - the design comes with no instructions, as even the children who use it are likely to figure out its purpose on their own, and find entertainment within the product.
4. **Perceptible information** - the shapes all have different properties, within size, colour and fabric, allowing for clear verbal instructions to be given should it be necessary, e.g. "find a big, fluffy circle".
5. **Tolerance for error** - there are no hazards within the design, other than a very small chance of a zipper getting stuck, though this is unlikely to cause any major physical harm.
6. **Low physical effort** - babies are able to sit, lie down, crawl, and stand on the mat.
7. **Size and space for approach and use** - even if the user is unable to move, they can still be placed down in various locations on the mat to explore their immediate surrounding area, while more mobile users are able to change locations and explore on their own.

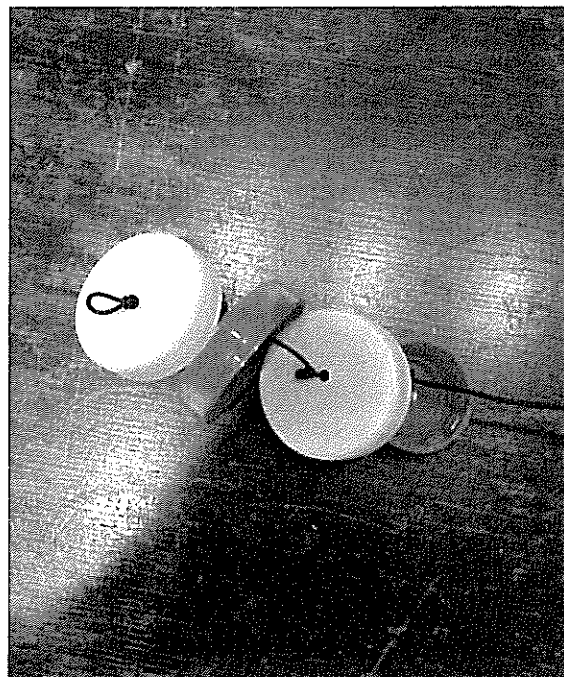
*Final products*



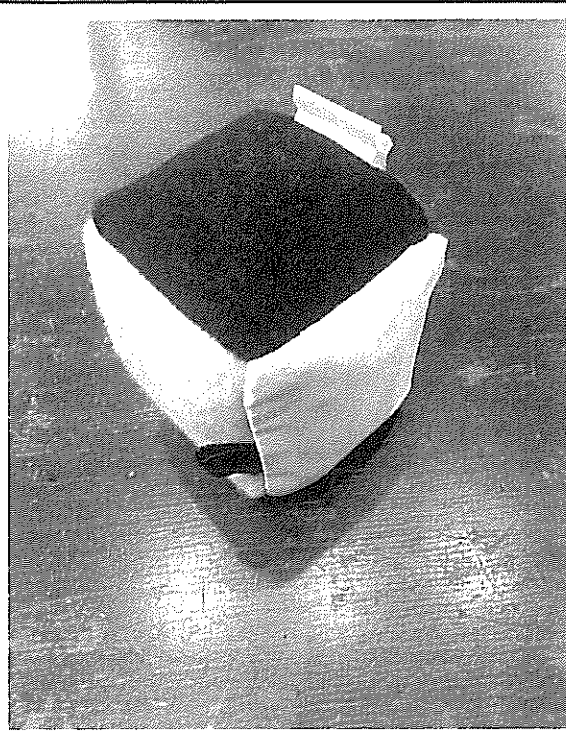
Playmat



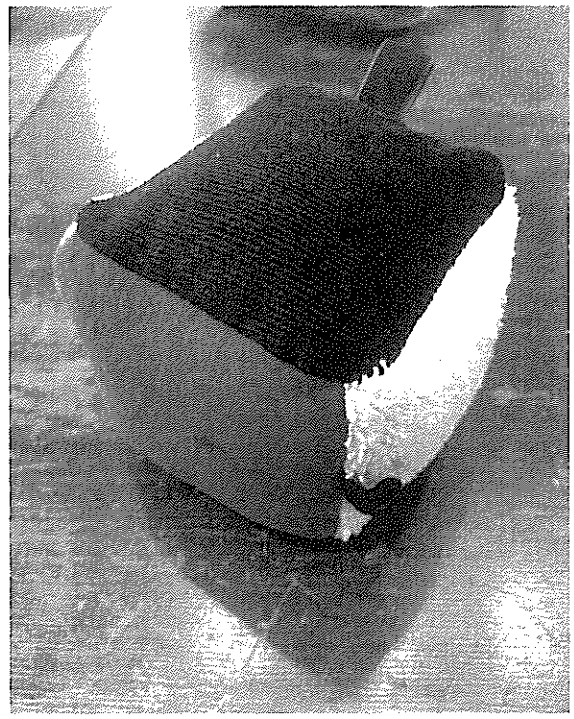
Monkey fists



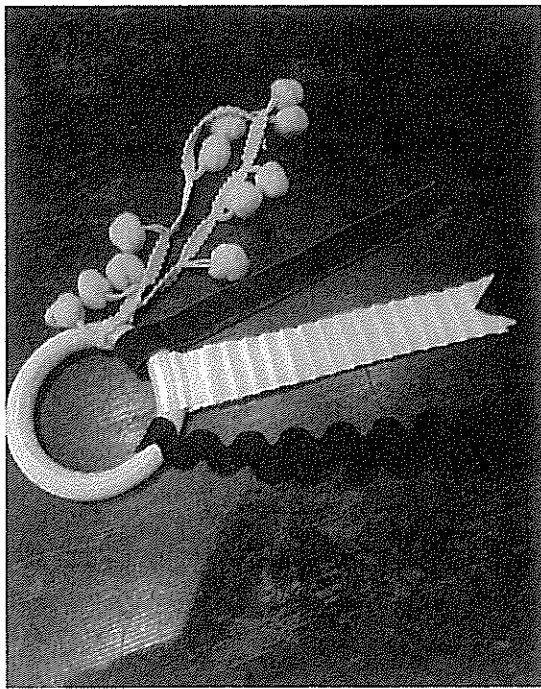
Bottle cap rattle



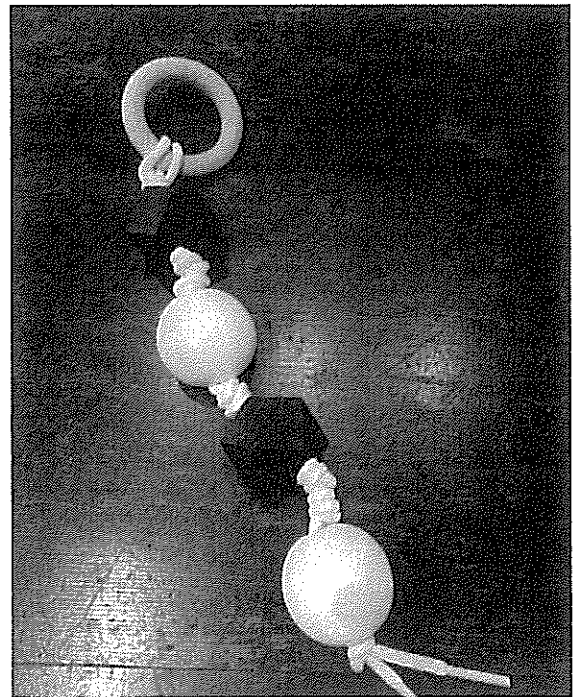
Smaller fabric block



Larger fabric block

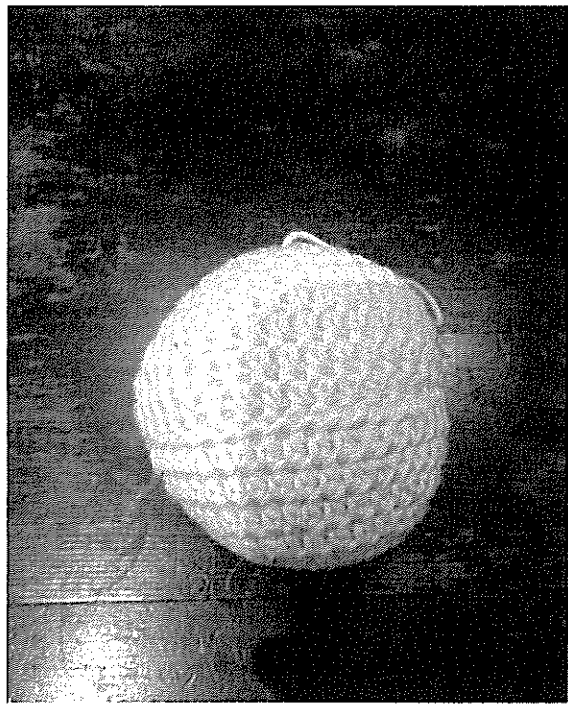


Sensory ribbon teething toy

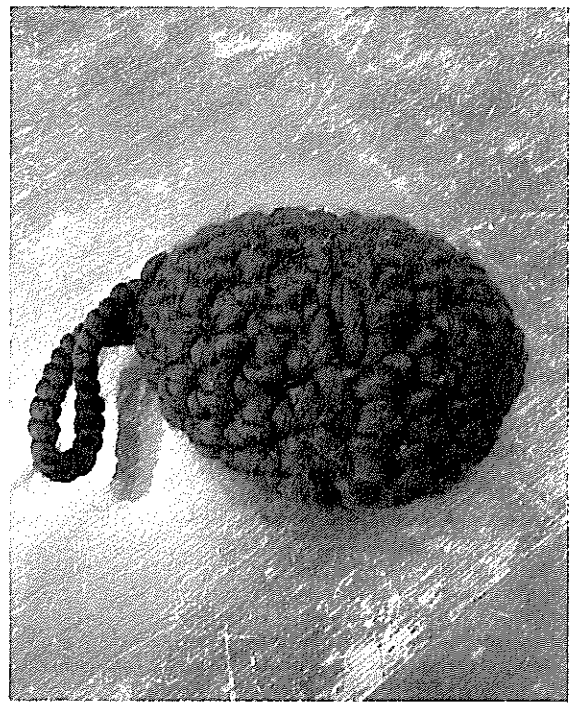


Wooden beads teething toy

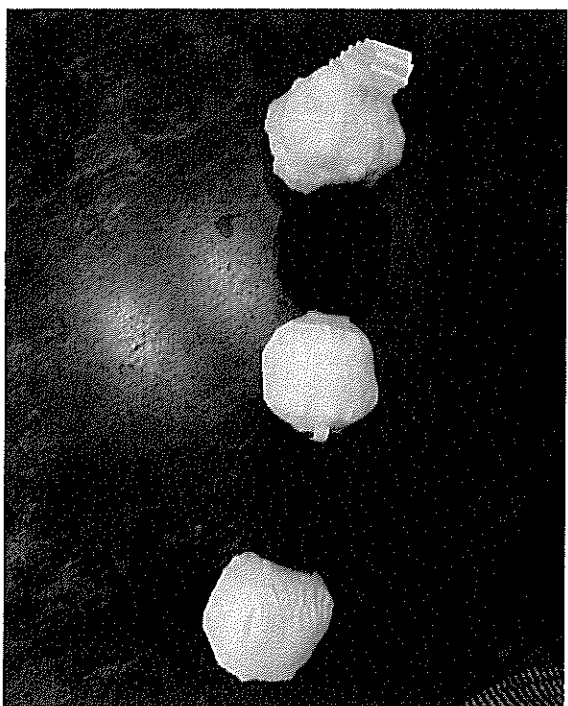




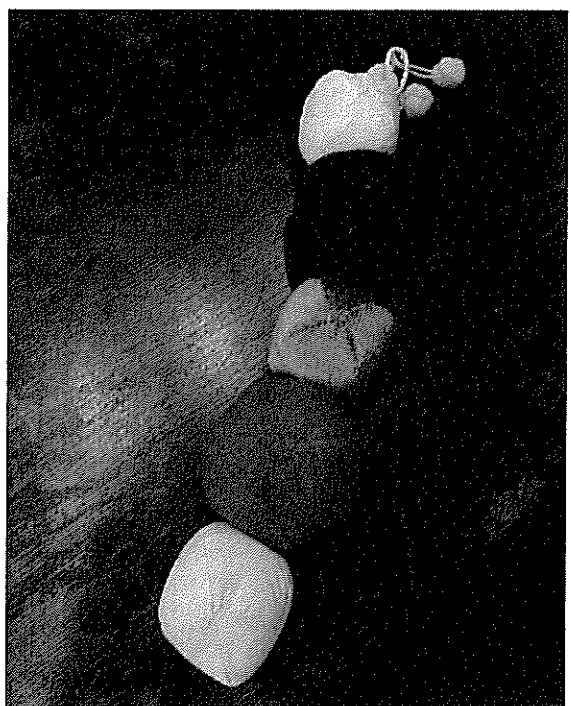
Yellow crochet ball



Black crochet ball



Black/white caterpillar (pull-apart)



Red/yellow caterpillar (squeakers)

*Final products in an example of their intended physical environment*





## **Evaluation**

### ***Reflecting products against original specifications***

Both the mat and the toys had to meet very similar specifications; sustainable and non-toxic materials, durable and machine washable materials, black/white and red/yellow contrast, ergonomically suitable, varying in texture and incorporating the principles of universal design. I feel that my final products meet all these specifications, as I researched and tested my materials before using them, observed a child playing with prototypes to ensure their ergonomic suitability and received feedback on the tactile properties of my fabric samples from my stakeholder. I have also shown that they meet the principles of universal design.

The mat assists in the encouragement of gross motor skills as the sensory elements are laid in a trail, so the children are able to explore their immediate surroundings, but also, with more confidence, follow the trail across the mat. The mat has six pockets and three elastic loops to attach the toys and there are no exposed raw edges.

The toys each have a purpose, some develop fine motor skills (like the pull-apart toy), and the others stimulate tactile and auditory perception. They are all safe for the children to put in their mouths, as there are no loose parts that may come off and become a choking hazard, and the materials are non-toxic. As they are safe, they meet the toy safety regulations that I am aware of. The toys all have loops so they can be tied to the elastic (seen right), or they can be inserted into the pockets.



The digitised pattern is in PDF format so it can be easily downloaded and distributed. It is designed to print on A4 paper, and the pieces are clearly labelled for their attachment. While the pattern is 54 pages long, this is due to the size of the mat, and the shapes are all grouped together to best economise the paper. Within the PDF pattern I have written instructions, which include clear instructions for the printing and assembly of the pattern, the application of the shapes and construction of the mat, and the crochet patterns for the bobble stitch squares and the waffle stitch squares. I also included QR codes that link to helpful YouTube tutorials for the skills needed to make the mat.

### ***Final meeting with the stakeholder (4)***

I was nervous for my final meeting with the stakeholder as if they felt the products were not suitable, I had invested a lot of time and energy into creating them and did not have

the time available to finish alternatives. However, I had taken on board all of their feedback during the development of my design and had ensured that my construction was accurate to create hard-wearing and durable products. I had asked if there would be an opportunity for one of the intended users to test out the mat, but as the Wellington resource centre service a wide area, most of their youngest clients live too far to travel to the centre just for my consultation. The final meeting also allowed me a chance to test out the bag that I had made, which was comfortable to wear on my journey (45-minute commute on public transport) and stored the products well. (picture shows me wearing the bag at the cable car, with the mat and the toys stored inside).



Overall, [REDACTED] was very pleased with the functionality of the mat and of the toys. They met each condition that she had given me over other consultations, allowing the products to meet the considerations within the social environment. She said that the larger size of the mat was definitely suitable. Other people working at the centre also came and had a look, as well as people on a Zoom call. They were all very surprised at how well everything had turned out, and everyone felt that the mat and toys were very fit for purpose and would be very helpful for their clients.

### ***Product life cycles and maintenance***

The overall life cycles of my products are likely quite long as I have ensured that my materials are hard-wearing and that the techniques I have used in construction are secure.

The mat can be machine washed on a cold gentle cycle to keep it clean over time. All of the toys apart from the wooden rings and bottle cap rattle can also be machine washed, and the non-washable toys can be wiped down easily as the surfaces are flat. The products should be air-dried as the dryer may cause damage to the embellishments, and the mat should be smoothed down as best as possible while it is still wet to prevent creasing. In general, the mat does not need to be regularly washed, but should it be noticeably unclean it is easily rectified.

When the mat and toys are not in used they should be stored in the bag. The mat should be folded and rolled so that it fits well and doesn't get squished and creased. Everything should also be stored away from sunlight to mitigate any sun damage that

may occur and cause the bright colours to fade and the contrast in the design to diminish. This is vital as if contrast decreases the overall fitness for purpose of the product also decreases.

Overall, the products are relatively low maintenance. This is important as the caregivers of the blind children who would be responsible for their maintenance have busy lives and more important things to worry about than the maintenance of a playmat.

### ***Disposal of product***

As I have tested the fabric's durability and dimensional stability, the mat should last for some time before it needs to be completely disposed of. When it reaches the end of its lifespan, it may be possible to remove parts of the mat and reuse the fabrics in other projects. However, this is mostly applicable to the primary fabric used in the mat - cotton poplin - as the other sensory shapes are not large enough to recycle. The white cotton can be recycled if the shapes are unpicked from the surface. 100% cotton fabrics can be recycled by shredding them and putting them in a compost bin as they are biodegradable. Cotton fibres mixed into soils can help with water retention if the soil is sandy and rocky. While it is possible to use the fibres to create new fabrics, fabrics made of recycled cotton tend to be of lower quality and have more problems during the manufacturing process.

Of the sensory fabrics, they are primarily made of cotton, polyester, or acrylic. The cotton fabrics can be disposed of in the same manner as the base poplin and the binding. The material is likely to degrade within a week to 5 months. However, as polyester and acrylic are not natural fibres, they are not biodegradable. It is possible to recycle polyester fibres, but ultimately these two fibres are likely to end up in landfill. While this is not sustainable, I feel that due to their durability and the fact that their use increases the lifespan of the product, it is okay that I have used them. I have also only used scraps and leftovers of such fabrics and yarn, which means that I have given them a second life before they are thrown away.

The buttons and zips on the mat can be removed and reused in other projects if they are still functional when the overall product isn't. The toys, which are largely constructed of the same materials as the mat, can have parts such as squeakers, knot bearings and stuffing removed (these parts can also be reused in other projects) and their other materials can be disposed of accordingly. It is also possible that in the event the toys outlast the mat, they can still be used as separate toys until their own function decays.

### ***Reflection on final evaluation***

This project has allowed me to get outside of my comfort zone when designing, developing and constructing a new product. I had never worked with an external stakeholder before as I had only worked with myself as the client. The whole process of taking on someone else's feedback and truly considering the physical and social environment of the product was new, but exciting to me as I intend to continue with design outside of high school and it gave me a chance to see what the real industry might entail. I was able to learn new construction techniques and processes, expand my technological knowledge, and branch into producing products outside of garments, which have been my typical products constructed for assessments in Technology. My determination to complete the project allowed me to overcome the challenges involved in my technological processes. I found that I gained a lot of satisfaction developing my own original product to tackle an important issue, and I like knowing that it is going to help people.

The ongoing issues with the COVID-19 pandemic threw spanners into the works over the course of this year and this project. However, scheduling my time and staying on top of the workload allowed me to work around these and still complete the project on time, which was a massive accomplishment.

While it was bittersweet to complete the project, as I have completed a digital pattern to reproduce my mat, I intend to stay in touch with BLENNZ to help provide any further information needed and look forward to hearing about the children that use the products.

## Letter from BLENNZ



**BLENNZ**  
...:~::~:

Blind and Low Vision Education Network NZ  
Te Kotuituinga Mātauranga Pura o Aotearoa

### EVALUATION REPORT FOR [REDACTED]

Blind and Low Vision Education Network NZ (BLENNZ) is the National School for the Blind. All children who have been identified as having vision impairment/blindness will be enrolled with BLENNZ – this could be from birth to the end of secondary education.

[REDACTED] has met with me several times over this year to discuss her idea re the production of a resource for a young child with severe loss of vision.

The final product, shows that she listened to what I and my colleagues shared with her re the need for:

- Clear contrast in terms of colour, using black and white, yellow and red, the four colours that have most impact to children with low vision and or cortical vision impairment.\*
- Exciting and varied tactile materials to encourage exploration and movement.
- A clearly defined space. The raised black edge to the mat will help the child to develop an awareness of boundaries and what is his own play area.
- A space that is exciting but that stays the same. The objects that are fixed in place have excellent colour and tactile variation, but also have shapes, colours and textures that can be compared and contrasted. This will assist in developing concepts – same and different, large and small, etc.
- Variation that can be introduced through: the additional toys that Julianna has made to tie on in different places; the pockets, which can provide additional excitement for the child through changing what is put into these.

[REDACTED] has very generously donated her completed work and it will become a resource for our Resource Teachers Vision who specialise in early childhood. With her permission I would like to upload her ideas and the pattern for this resource to the BLENNZ Group Drive so that this well-thought-out resource can be duplicated by my colleagues around the country.

[REDACTED]  
Resource Teacher Vision  
BLENNZ Wellington  
[REDACTED]

\* Cortical vision impairment may occur where there is damage to the brain, and the BLENNZ students who use this type of resource include not just children who are blind but also those who have complex needs.



**BLENNZ Wellington**

t. 04 939 5006 / w. [www.blennz.school.nz](http://www.blennz.school.nz)  
27 Kowhai Road / Kelburn / Wellington 6012

## References

Note: all unreferenced images are my own and have been used with permission.

- Allure. (2020, April 25). *Every Way Being Blind Makes My Life Different (Ft. Molly Burke)* | Allure [Video]. YouTube. <https://www.youtube.com/watch?v=zE9U7zLDFI>
- Allure. (2021, January 27). *Molly Burke Reviews: Blind Accessibility of Beauty Products* | Universal Beauty | Allure [Video]. YouTube. [https://www.youtube.com/watch?v=u2Xx\\_C5X9IM](https://www.youtube.com/watch?v=u2Xx_C5X9IM)
- American Printing House. (2021, November 1). *Laptime and Lullabies: Storybooks*. Retrieved from <https://www.aph.org/product/laptime-and-lullabies-storybooks/>
- BLENNZ. (n.d.) *Our Curriculum*. Retrieved February 12, 2021, from <https://www.blennz.school.nz/curriculum/>
- BLENNZ. (n.d.). *Our Vision*. Retrieved February 12, 2021, from <https://www.blennz.school.nz/about-blennz/our-vision/>
- BLENNZ. (n.d.) *Eye conditions*. Retrieved February 15, 2021, from <https://www.blennz.school.nz/guides-and-resources/eye-conditions/>
- BLENNZ. (n.d.). *BLENNZ logo* [Logo]. BLENNZ. Retrieved from <https://www.blennz.school.nz/>
- Brambring, M. (2006). Divergent development of gross motor skills in children who are blind or sighted. *Journal of Visual Impairment & Blindness*, 100(10), 620-634.
- The Bump. (2018, May 3). *18-Month-Old Development Milestones*. Retrieved from <https://www.thebump.com/toddler-month-by-month/18-month-old-month-old>
- Burke, G. (2016, July 25). *Celebrating architects who overcame disabilities*. Retrieved February 16, 2021 from <https://web.archive.org/web/20180319231609/https://www.aia.org/articles/14786-celebrating-architects-who-overcame-disabili:26>
- Butler, J., Holden, K., & Lidwell, W. (2003). *Universal Principles of Design*. Rockport Publishers, Inc.
- Casey, L. (2018, November 13). *6 Reasons to Use Acrylic Yarn When Knitting Children's Clothing*. Retrieved from <https://www.lyndasnurseryknits.com/blog/6-reasons-to-use-acrylic-yarn-when-knitting-childrens-clothes>
- FitzGerald, J. (2020). *The Fashion Industry's Problem With Waste*. Retrieved from <https://www.makegood.world/fashions-problem-with-waste>
- Flanders DC. (n.d.). *End of life*. Retrieved from <https://www.close-the-loop.be/en/phase/3/end-of-life>
- Jeamwattthanachai, W., Wald, M., & Wills, G. (2019). Indoor navigation by blind people: Behaviours and challenges in unfamiliar spaces and buildings. *British Journal of Visual Impairment*, 37(2), 140–153. <https://eprints.soton.ac.uk/42717>

- Larson, J. (2019, November 20). *What Do Blind People See?* Retrieved February 15, 2021, from <https://www.healthline.com/health/eye-health/what-do-blind-people-see#research>
- Levtzion-Korach, O., Tennenbaum, A., Schnitzer, R., & Ornoy, A. (2000). Early motor development of blind children. *Journal of paediatrics and child health*, 36(3), 226-229.
- Nielsen, L. (1993). *Early Learning, Step by Step, in Children With Vision Impairment and Multiple Disabilities*. Copenhagen, Denmark: Sikon.
- Nielsen, L. (2013). *Functional Scheme: Levels 0-48 Months*. Lilli's Consultancy for Active Learning.
- NZTDA. (n.d.) *New Zealand Toy Safety Information*. New Zealand Toy Distributors Association, Inc. Retrieved July 20, 2021, from <http://nztda.org.nz/information-for-parents/toy-safety>
- Paths to Literacy. (2013, July 22). [Photograph showing a vision impaired child using an example of a "Little Room"]. Retrieved from <https://www.pathstoliteracy.org/blog/remembering-lilli-nielsen-and-her-legacy-active-learning>
- Rossetti, R. (2006, December). The Seven Principles of Universal Design. *Action Magazine*. Retrieved February 16, 2021, from <https://www.udll.com/media-room/articles/the-seven-principles-of-universal-design/>
- Sewguide. (2021, June 23). *13 types of fabric suitable for baby clothes & children's clothes*. Retrieved from <https://sewguide.com/fabric-for-baby-clothes-childrens-clothes/>
- Smyth, D. (2021, September 16). *How to Dispose of Cotton*. Retrieved from <https://homeguides.sfgate.com/dispose-cotton-79249.html>
- Steinfeld, E., & Maisel, J. (2012). *Universal Design: Creating Inclusive Environments*. John Wiley & Sons, Inc.
- Wikki Stix. (n.d.). *Braille Alphabet Chart* [Chart]. Tactile Learning: Creating the Braille Alphabet with Kids. Retrieved from <https://www.wikkistix.com/tactile-learning-creating-braille-alphabet-kids/>
- World Federation of the Deafblind. (2018, September). *Initial global report on situation and rights of persons with deafblindness*. [https://senseinternational.org.uk/sites/default/files/WFDB\\_complete\\_Final.pdf](https://senseinternational.org.uk/sites/default/files/WFDB_complete_Final.pdf)

## Scholarship exemplar 2021

<b>Subject:</b>	<b>Technology</b>	<b>Standard:</b>	<b>93601</b>	<b>Score:</b>	<b>15</b>
<b>Q</b>	<b>Score</b>	<b>Annotation</b>			
Synthesis and integration	05	<p>This project developed an outcome for an authentic issue, creating a sight-impaired young child's playmat that is stimulating and engaging for the user.</p> <p>The final outcome was well constructed, and utilised multiple materials and components within the outcome, to produce an interesting product that is captivating and safe to interact with. There was deliberate decision-making around materials used and the techniques and processes employed during development and construction / manufacture.</p> <p>The candidate demonstrated planning and organisation to enable completion of the project. The product clearly met the requirements of the brief, with these featuring in commentary throughout the project. Stakeholders, including a Blind and Low Vision Education NZ (BLENNZ) ECE teacher, a parent, and a child were consulted, and feedback contributed to decision-making and subsequent action during the project.</p> <p>There was evidence of ongoing testing and evaluation throughout, including final testing through in-situ interaction with a sight-impaired child and final stakeholder evaluation. The technological practice utilised, and the outcome produced, demonstrated some elegant synthesis of knowledge, skills, and ideas, and was clearly driven by the candidate to complete the project within the timeframe. As challenges or issues arose, the candidate used further trialling to address these and make further decisions.</p> <p>Overall, a reasonably good level of synthesis and integration was demonstrated throughout.</p>			
Justification	05	<p>Systematic development is evident in the process used, and justification of decisions was coherent. Stakeholders were vital to the development process. Because they were genuinely invested in the playmat, their feedback was ongoing, authentic and meaningful, and was reflected in the final outcome. Relevant and specific questions for stakeholders elicited meaningful feedback, so that the student was in the best position to make effective decisions.</p> <p>Throughout the process, clear next steps and improvements were identified. Analysis throughout the report was relevant and purposeful. There was evidence of relevant testing and evaluation of materials and techniques/processes, which has enabled informed decisions during project development. Both subjective and objective tests were explained and utilised appropriately. As a result of this testing, the outcome was feasible and able to be realised.</p> <p>Further feedback and usage of the outcome by the target market within the wider ECE / parent community could have enabled further refinement, polish and elegance.</p>			
Critical reflection	05	<p>The report demonstrated a clear narrative from start to finish. The candidate demonstrated reflection on key decisions throughout. There was clear and consistent evidence of the candidate's thinking about the process and outcome.</p> <p>A reasonable level of relevant reflection and evaluation was clearly evident throughout. This enabled the candidate to make informed and reasoned decisions, modifications and adaptations during product development as issues arose. It was easy to understand why the candidate made decisions.</p> <p>The end result was a professional-looking product that appears to have the potential for further development, and testing and evaluation.</p>			