Braille Bricks

Bianca (Bee) Handel

Product Purpose

This portfolio and the braille bricks were created as a school assignment focused on human centred design.

The goal of this task was to create a product that was specifically designed as a toy or educational product for children. I elected to go down the educational route, with a focus on creating a product that was disability friendly, but remained inclusive so as not to isolate visually impaired children from their non-visually impaired classmates.

Design Brief / Explanation

Design Problem / The Need:
Through my research into existing products, as well as detailed information provided from teachers and educators, it has been identified that two key issues are faced in youth education and the development of communication skills. The main issue is a lack of resources that are both fun and engaging, while accessible to students with varying abilities. Commonly each tool is individualised to one specific need and as a result limits functionality in a group setting, which ultimately can be linked to impaired social and communication skills. Furthermore, it has been identified that while products exist that target children with vision impairments of additional focus and communication needs, these are often aimed at a younger age group, and are not functional in terms of growing skills as the child grows up.. This a major gap in the market as it is very uncommon that children are learning exclusively by themselves (Img 1.3), or that their literacy and communication skills are not continuing to be developed. Hence, the identified need is to create a multifunctional, literacy based product, that is accessible to students with varying capacities and disabilities.

Design Brief:
Throughout the remainder of this project I will be exploring solutions to the need identified above, with a particular focus on products that would **assist vision impaired students to collaborate, communicate and play with non-vision impaired students**. Alongside this, a key focus will be on **building intermediate literacy skills** such as sentence construction in the hopes of addressing the low braille literacy rate in Australia that was identified in Figure 1.3.

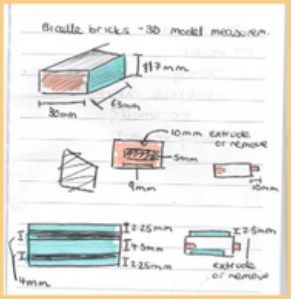
There are a few constraints that must be adhered to throughout the undertaking of this project. Namely, these apply to **time, cost, materials and the target audience** of the project. As this is a school assessment task the final prototype must not cost very much, and must be built from readily accessible materials at the school such a wood, acrylic, cardboard, spray paint etc. In much the same way there are **limited production processes** available such as handwork, laser cutting and 3D printing. In addition to this, the **project must be completed by week 5**, and hence the portfolio and construction work must reflect this short timeframe in terms of depth. Most importantly though, the assignment criteria set that this project must focus on **communication for young children** around the primary school age of about **6 - 9 years old**.

Constraints aside, my final design must address the communication needs of vision impaired students, but it must also take into account additional criterion such as **safety, durability, aesthetics and educational functionality**. For example, the product must be of a **size** that does not pose **choking hazards**, while still being **small enough** for young hands. A key criteria is making sure that the product makes use of **sensory input** in a way that is engaging and practical **without overwhelming** the child, such as using **unobtrusive** and **safe materials**, while adding **visual and tactile elements** to engage the child.

Construction + Design Process

The braille bricks were constructed in a very short time frame. The assignment was given less than a term for completion, of which I spent the vast majority researching and generating ideas. In order to produce a prototype of reasonably high quality, I used Onshape to create 3D models that could be 3D printed. 3 prototype bricks were created for submission, but sketches, cardboard mock-ups and initial 3D printed ones were also developed. These additional models were continually evaluated (colour coded in green boxes) and compared to the design criteria and research. This evaluation resulted in gradual design changes to improve my final prototypes.

Excerpts from my portfolio: construction and evaluation



2. Final OnShape Model Construction

After making the decision to invert my measurements, Time was taken to explore how these adjusted dimensions would interact. This is pictured in the small sketchbook page scan to the left. This step was fairly straightforward as I was able to play around with how the changes would physically look through use of OnShape. Highlighting of the parts was also incredibly useful for keeping track of thoughts and making the diagrams easier to understand.

Once these measurements were decided, I began working in OnShape again. Initially this step was progressing very efficiently, however, I was unable to add text to the top of the brick, due to the orientation of the planes. Unfortunately I was unable to to adjust the planes due to the document set up, however, I was able to note the measurements and begin working in a new document to create the final 3D model.

3. Final Prototype (Stage One)

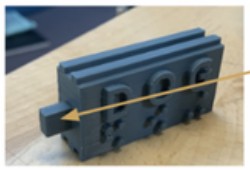
As I had substantial time available to complete this project, I allowed myself to complete an initial 3D prototype before constructing ones in full colour. This prototype was constructed in grey plastic filament, and essentially served as a test as to whether my brick was in the right scale, met criteria and was structurally sound. In order to 3D print this prototype I constructed the model on Onshape and then converted it to a mm based STL which I was able to export and send to the 3D printer. During this process, Mr McAllister also helped me to add additional supports to reinforce the letters so that they did not print separately. Photos from this process can be seen to the left

6. Initial Model Evaluation

Before continuing on with the remainder of the construction process, I wanted to evaluate this initial grey prototype, and discuss any possible improvements with other peers. This evaluation is pictured to the right.

Ultimately, taking the time to evaluate this initial model was incredibly valuable, as several issues were identified. These issues are not significant, however, they will need to be fixed in the next CAD models before printing. By making these improvements the design will be more successful and better meet the criteria required. It also became essential to conduct brief, but further research into braille conventions to further increase design suitability.

Space between each braille dot/cell is very small, making them difficult to distinguish. This is a major flaw and will significantly impair functionality if not improved in the next model. One possible solution is to not only space out the dots more, but also to round them out more. This will be beneficial as it will mean it is not a flat surface against the finger, thereby increasing distinguishability. Rounded dots is also more characteristic of a standard braille cell, which is important for truly improving literacy.



Another issue was that the side joins were not central, which presents a minor visual disturbance, but may also hinder the ability of a visually impaired student to accurately line up and connect the bricks, as they are not able to line up the side of each brick to assist.

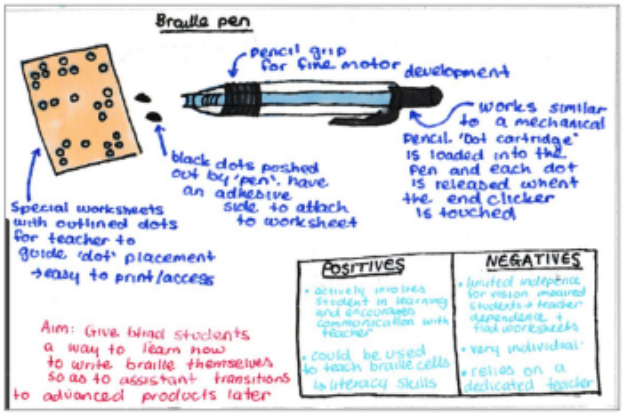
When text on one side is oriented the correct way (as pictured) the text on the other side is upside down, with the letts back to front and the braille at the top. This potentially reduces the functionality of the bricks as another child is not able to read a word on the other side, reducing communication.

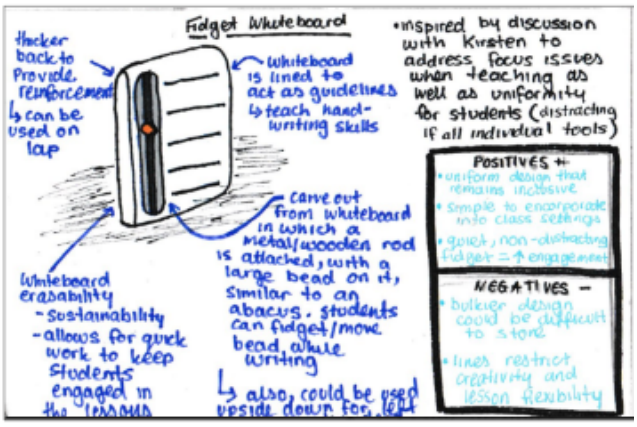
While a flaw, this does mean that the issue of incorrect sentences being accidentally constructed on one side due to mismatched word sets is avoided. Additionally, an important point raised in discussion with another classmate was that having the inverse orientations meant that the start of a word was always closest to the protruding side. This is a massive asset when teaching visually impaired children as it allows them to independent navigate the bricks. Hence, it was decided that these positives outweigh the need for change

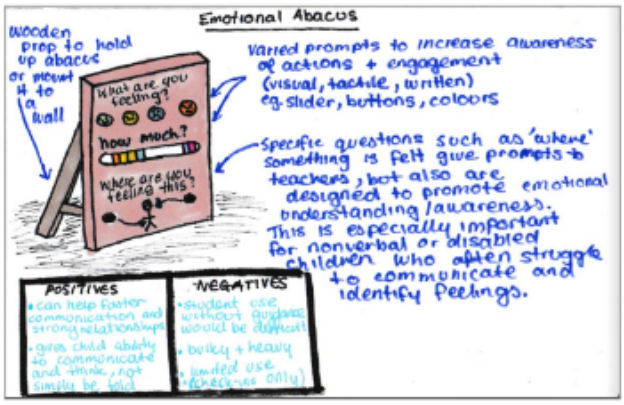
Exemplar Pages

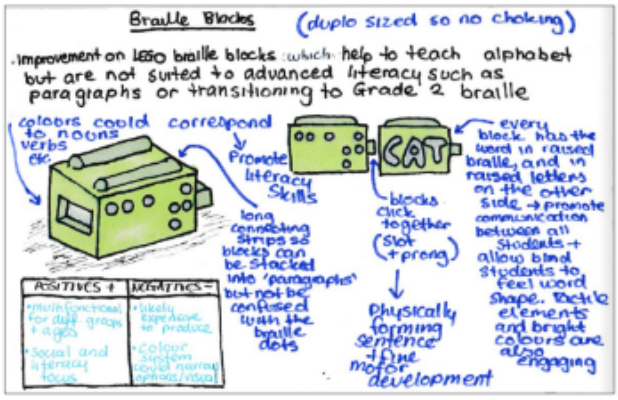
7. Idea Generation

Pictured to the right are four thumbnail sketches of designs intended to overcome specific issues surrounding communication within childhood education. Two of the designs focus heavily on providing means for vision impaired children to develop literacy and fine motor skills, one is focused on provided an additional means of communication for students, and the final design focuses on class engagement and literacy/communication in a class setting. These are all hand drawn, and annotated in regards to the purpose of design features, and then briefly evaluated.







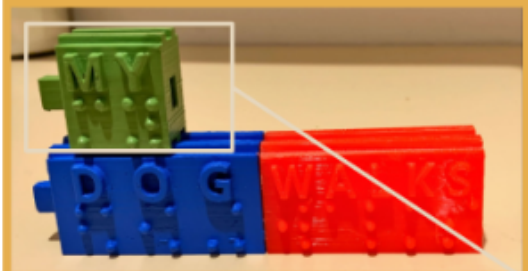


Ergonomics:

- → Bricks are sized to comfortably sit in the hands of a child without being difficult to handle
- → Words are always oriented to be read from the 'protruding join.' This allows vision impaired students to physically navigate the brick

Safety:

- → Bricks are identical to the size of duplo, which pass australian toy standards regarding choking hazards. The large size of the 'braille bricks' means that they cannot easily be swallowed ot eaten by children.
- → Bricks are completely solid, adding additional structure to each brick and ensuring that it cannot easily be pulled apart
- → Bricks are not heavy, meaning that they will not cause significant damage if dropped or thrown towards a child or glass etc.

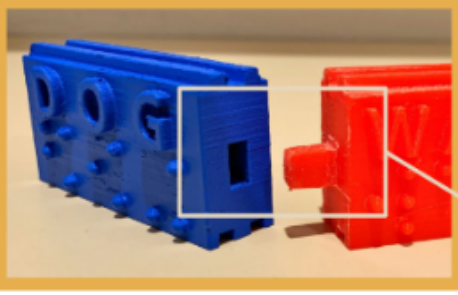


Aesthetics:

- → Colours are of similar shades and not too obtrusive on the eyes. This means that children will likely be attracted to the bricks, without feeling overwhelmed
- → Physical design is not extravagant, thereby not detracting from the more important functionality,

Quality

- → Bricks are soundly constructed and have significant structural integrity
- → Unfortunately the spray paint has meant that the green brick no longer connects horizontally, which does reduce the quality of this final product.



Function:

- → Bricks include both alphabetical and braille text. This improves multi-functionality and communication potential
- → Bricks are colour coded per survey responses to allow them to be used to teach core literacy skills to sighted children
- → Bricks have a double joining system to allow them to connect vertically and horizontally, thereby helping to develop fine motor skills, and also allow for creativity.