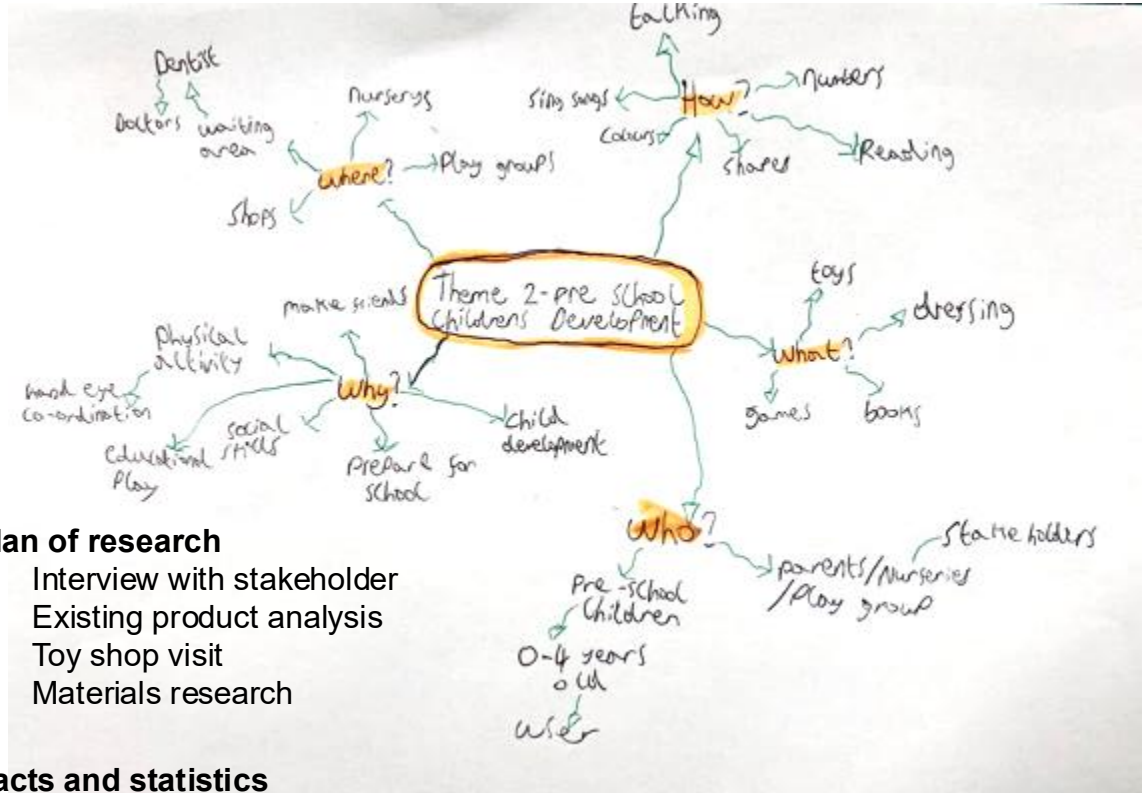
Design & Technology GCSE Project: Pre-school Children's Development

1.1 Investigation of needs and research

Chosen theme – Pre-school Children's Development

1.(a) How can products be used to help pre-school children develop their capacity to learn?



Plan of research

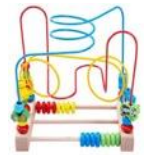
- Interview with stakeholder
- Existing product analysis
- Toy shop visit
- Materials research

Facts and statistics

- 80% of a child's brain develops in the first 3 years.
- Early childhood education prepares children for school life.
- Early childhood education teaches them to be responsible for their actions.
- Without an early high quality education children are 25% more likely to drop out of school.
- 50% of children who don't receive a high-quality education are more likely to be placed in special education.
- 60% of children who don't receive a high-quality education are more likely to never attend college.
- Early education helps to teach the kids important values.

Primary User Profile:

- 1 year-old
- Boys & girls
- Goes to nursery / pre-school
- Attends play groups



Stakeholders:

- Parents [buyers]
- Shopkeepers [buyers and sellers of the product]
- Play group leaders [entertainment]
- Early years teachers [child development]
- Waiting room / receptionists [entertainment]

Problems & Opportunities

- In a doctors waiting room the children may get bored. The toys can be an opportunity to keep the kids entertained while waiting for their appointment.
- In a nursery the early years teachers try to prepare the kids for school. There is an opportunity for me to design the product to help teach basic numbers, letters, shapes, colours, the alphabet and help with reading. This can help prepare the children for when they join a school.
- At home children may be gifted toys by members of their family e.g. grandparents. I could design and make a seasonal gift for grandparents to give their grandchildren at Christmas
- Parents want their children to have fun but learn and develop at the same time. Therefore, I could create a product that's fun but also educational.

1.1 Investigation of needs and research

Existing product analysis

I have collected a range of children's toys. I am going to analyse them to help me with designing and making my own children's toy. These products already exist on the market so that will be my competitor/competition.

Product 1 Wooden Geoboard

Form: The main shape is a square board in a square box. The corners are rounded as it is safer than using pointed/sharp corners. There are nails sticking out of the board with enough room for children to wrap the elastic bands around.

Function/Performance: This product is a wooden board with nails witch children can attach elastic bands on to make shapes. The packaging describes the toy as a "mathematical and educational toy for children to learn 2D geometrical figures and shapes". Children will also use and develop their fine motor skills when they are attaching and bending the elastic bands round the nails. Maths skill are improved as they must count the nails and match it up with the image. The images are numbered and ranged in difficulty. The children can improve their colours by matching the image with the elastic bands.

Client / User: The clients who would buy the product are parents, waiting room receptionists, nurseries, and play groups. The user of the product is children age 3+. I believe children. Over 7 wouldn't use the product as they would find it easy and boring. This toy can be used by either boy or girl (unisex).

Sustainability: The main material is wood which is a natural material and is sustainable. There is a recycle symbol on the back of the box.

Materials and components: They have used plywood for the board which is light and easily cut and shaped. As it is a manufactured board, it is also relatively cheap. They have also used elastic bands, stainless steel for the pins , glue, corrugated cardboard for the packaging. Cardboard has been used for the box as it is recyclable, light and protects the product

Scale of production and cost: it costs £19.95 from amazon. I think this price is too high personally as I wouldn't pay more than £10.The box says made in China therefore I think hundreds thousands of products will have been made.

Aesthetics: They have made the box colour green to make it look more environmentally friendly. The manufacturers name is Panda Brothers hence why they have designed bamboo on the box. The board is the perfect size for kids, the cards have clear and child friendly pictures. There is also a warning on the bag where the cards are held "Plastic bags can be dangerous to avoid danger of suffocation, keep this wrapping away from children"

Marketability: As it's a product on amazon I believe it would be promoted to amazon customers through reviews and recommended similar toys e.g. when looking for a specific product other products will pop up as it may be related.

Consideration of Innovation: what makes this product different to others is it has a nicely designed box, rounded corners and a large geoboard size.

1.1 Investigation of needs and research

Existing product analysis

Product 2 Hands Jig-saw

Form/Aesthetics: This toy has bright bold colours maybe to make it more appealing and fun towards younger kids. The corners are rounded and smooth for a safer use, The toy is made from plywood and has been sanded down for a smoother feel. There is a laminate sticker over the board which stops things from staining the board.

Function/Performance:
The function of this product is to help the children learn their numbers Aswell as their left and rights and their motor skills. Their motor skills can be improved using this product by slotting the wright numbers into the correct places

Client / User: The stakeholder of this product would be parents of the children or other family members e.g. grandparents, siblings. Nursery's, waiting room receptionists, play groups. The user of this product would be children aged 0-3 . Older children may find this toy boring.

Scale of production and cost:

Materials and components: The front of the board is made from plywood whereas the bottom layer is made from MDF. These are both manufactured board.

Sustainability: The manufactured board used can be seen as environmentally friendly as they can be made from old wood products and waste wood.

Marketability: This toy could be sold in shops such as Smyths ,Tesco ,Aldi and B&M. The toy could also be advertised on tv which will get attention of stakeholders of the product such as : parents nursery teachers.

Consideration of Innovation: This product is different to others and unique as it teaches children to learn their left rights Aswell as their numbers and even motor skills all at the same time.

Product 3 Weather play board

Form/Aesthetics: The bottom of the toy is flat, but the top of the toy is rounded. The colours are unique as they are quite subtle and pastel whereas other toys have more flashy and bright colours.

Function/Performance: This product is multifunctional as it teaches kids the weather, moon phases, the months, the days and even temperature. These are very important things for a child to learn at a young age and help develop their brain.

Client / User: The client/stakeholder would be the parents, Nursery's ,waiting room receptionists. The user is the children aged 3-5.

Materials and components: The material of this toy is plywood which has been varnished to keep out stains.

Scale of production and cost: This product is manufactured by 'little town' and the retailer is Aldi I believe this toy would be around £10. I visited Aldi to have a look at the toy selection for further detail scroll to the next page.

Sustainability: The plywood made to use this product is sustainable.

The CE logo seen on the back of the product indicates that the manufacturer meets with European health, safety, and environmental standards. This is the same for the UK CA logo and UK standards.

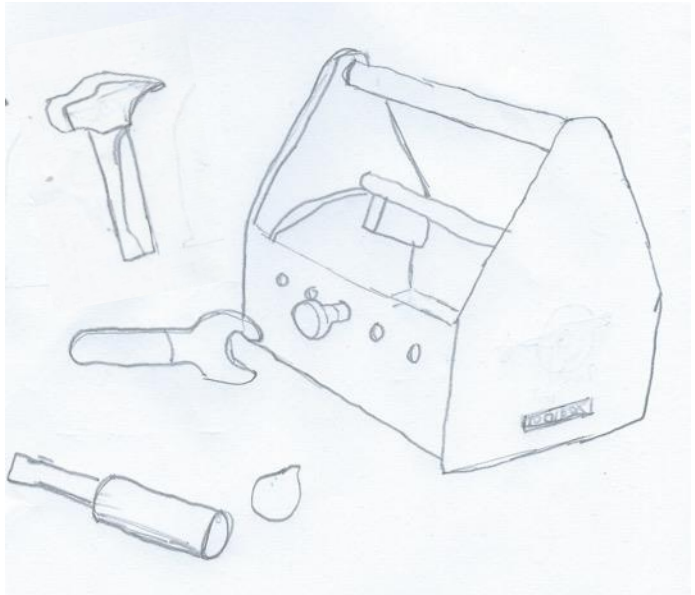
Marketability: This product is sold in Aldi and on amazon. Amazon have a magazine which promotes lots of different things such as this toy. I believe it would be promoted to amazon customers through reviews and recommended similar toys.

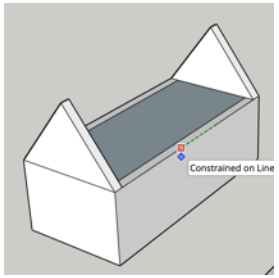
Consideration of Innovation: This product stands out from its competitors by having 6 different functions within 1 product.

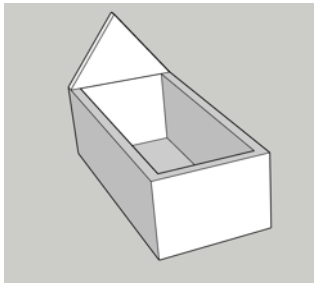
2. Design Ideas

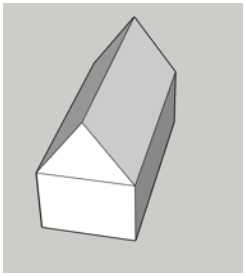
2. Design Idea 1

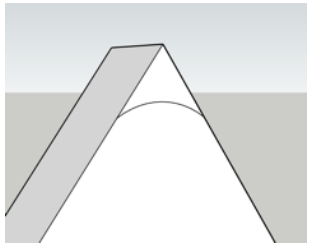
Audio 2
Transcript on slide 20

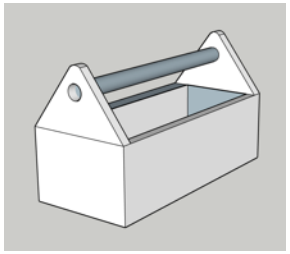


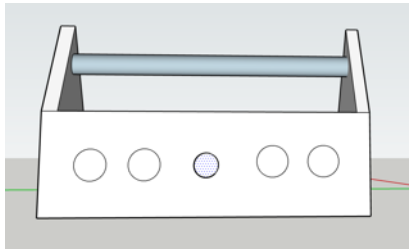


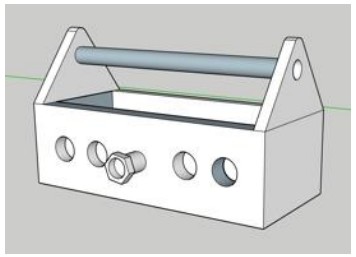












I started of with a hand-drawing of the toolbox. This toolbox would for be for a pre school child to roleplay as an adult.

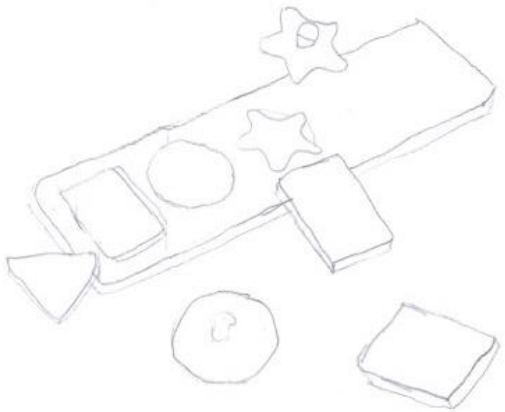
Then I created another design on a computer using CAD (computer aided design). An advantage for CAD instead of hand-drawing is that its more accurate, precise, easy modifiable and quicker. The disadvantages are that computers can become corrupt, and work may not be saved.

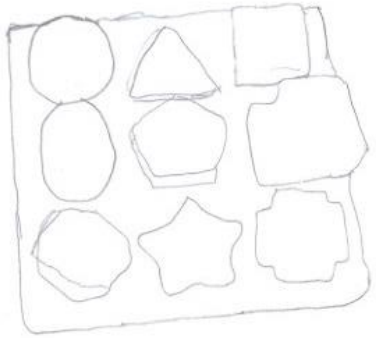
I created a model using corrugated cardboard, I measured the cardboard into pieces cut them out with my scalpel and glued them together using my hot glue gun.

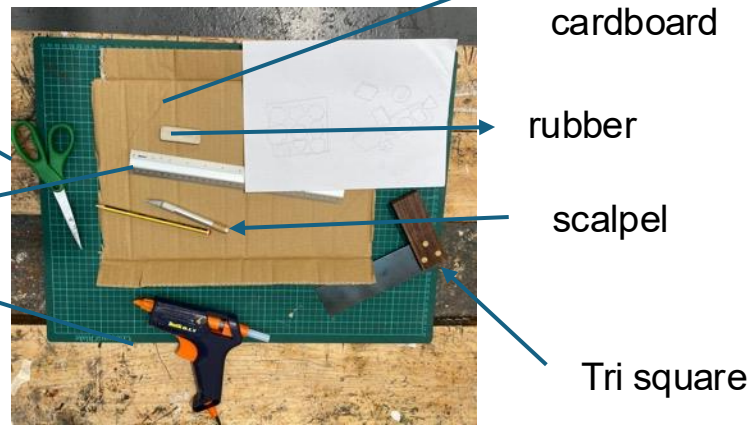
Looking back at my initial specification I can say this toolbox idea would entertain pre school children. However I doesn't have any educational features such as letters, numbers – it is more of a roleplay kind of toy. I rounded the corners of the triangle to make it safer to use for a pre school child this meets the performance requirements specification points. Its more of a toy to be kept at home or at a nursery since its more of a larger toy. This toy may not be able to be stored when not in use since its quite big and the shape will not allow anything to stack on top. Stereotypically this toy would appeal more to boys than girls, this would limit my potential market.

2. Design Ideas 2

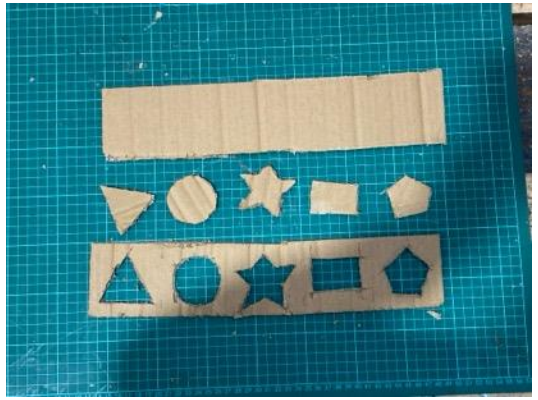
Audio 3
Transcript on slide 20







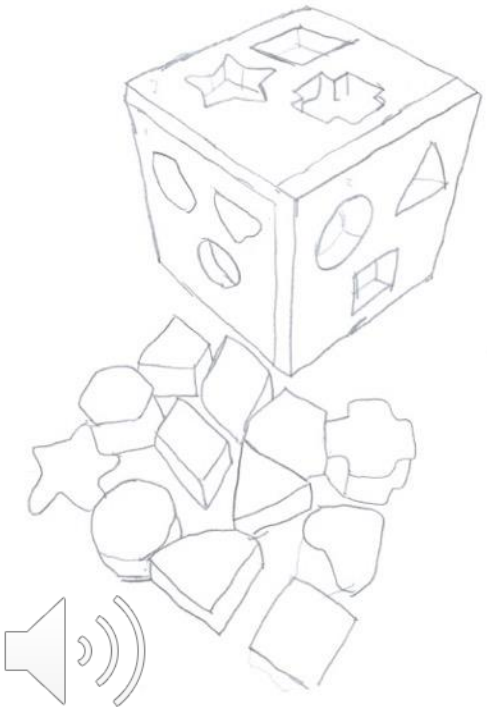
I have produced a cardboard model for one of my design ideas. Modelling is important so we get practice and so we don't mess up the real thing and waste materials, time and money.



I got some corrugated cardboard and marked out the shapes with my pencil, then I got the scalpel and cut out the shapes I measured out. I then got the hot glue gun and stuck my cardboard with the shapes on it onto another piece of cardboard. I then got my dowel onto a vice and cut out 5 small handles. I sanded them and stuck them onto my shapes using my hot glue gun. This is how my user will remove and put in the shapes to jigsaw.

2. Design Idea 3a and 3b

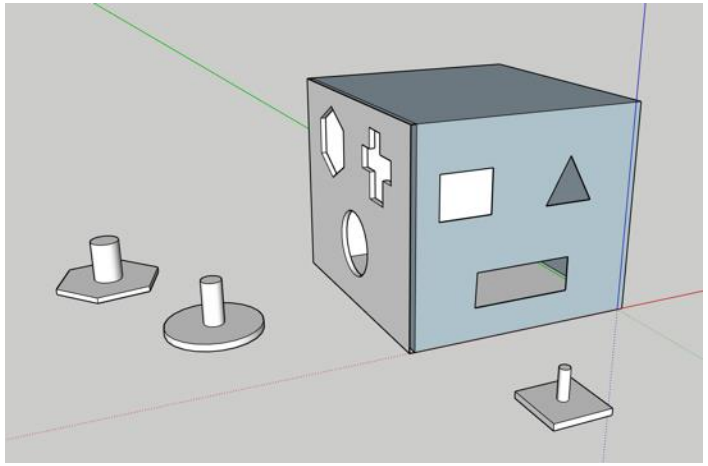
Audio 4
Transcript on slide 20

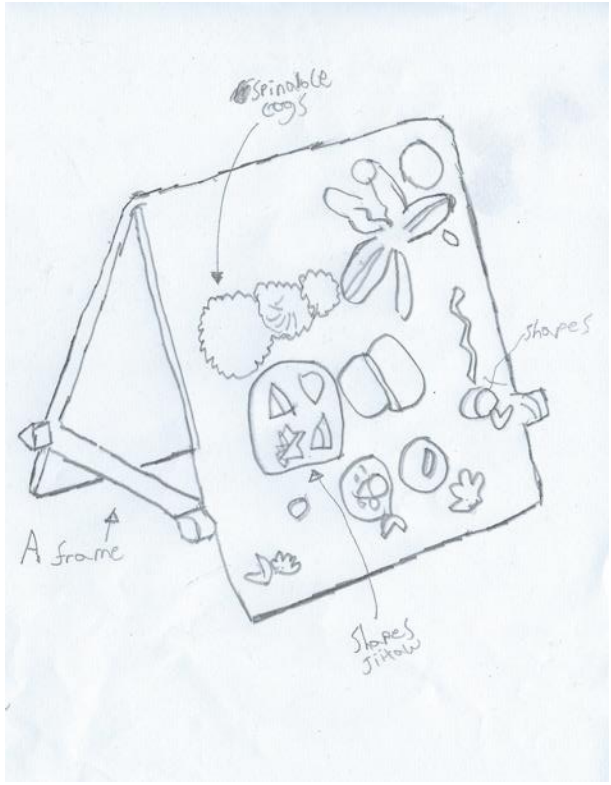


Design Idea 3a
With this model I measured out 6 squares 20cm by 20cm, then I cut them out with my scalpel. Then I cut out the puzzle shapes. After that I got the hot glue gun and k the squares neatly together into a box. Then I stuck my dowel onto the shapes.

This children's toy does have the potential to combine letters and numbers. I could develop the product by having different features on each side for e.g. letters on one side numbers on the other side. This toy would be very good for building children's motor skills and hand eye co-ordination. This is a positive design feature because hand eye co-ordination was number 4 on my survey. Some shapes are sharp and may cause harm and the dowel may be a chocking hazard. This product may not be able to be took allot of places since it is quite a big toy and might cause difficulties travelling with. To store this the pieces will have to be in the box but other than that this will be a very easy toy to store since the shape is easy –fitting .Cleaning this would be difficult since there is allot of components. If I was to create this product with wood it would be environmentally friendly and sustainable. This product could be made with bright colors to appeal pre school children.

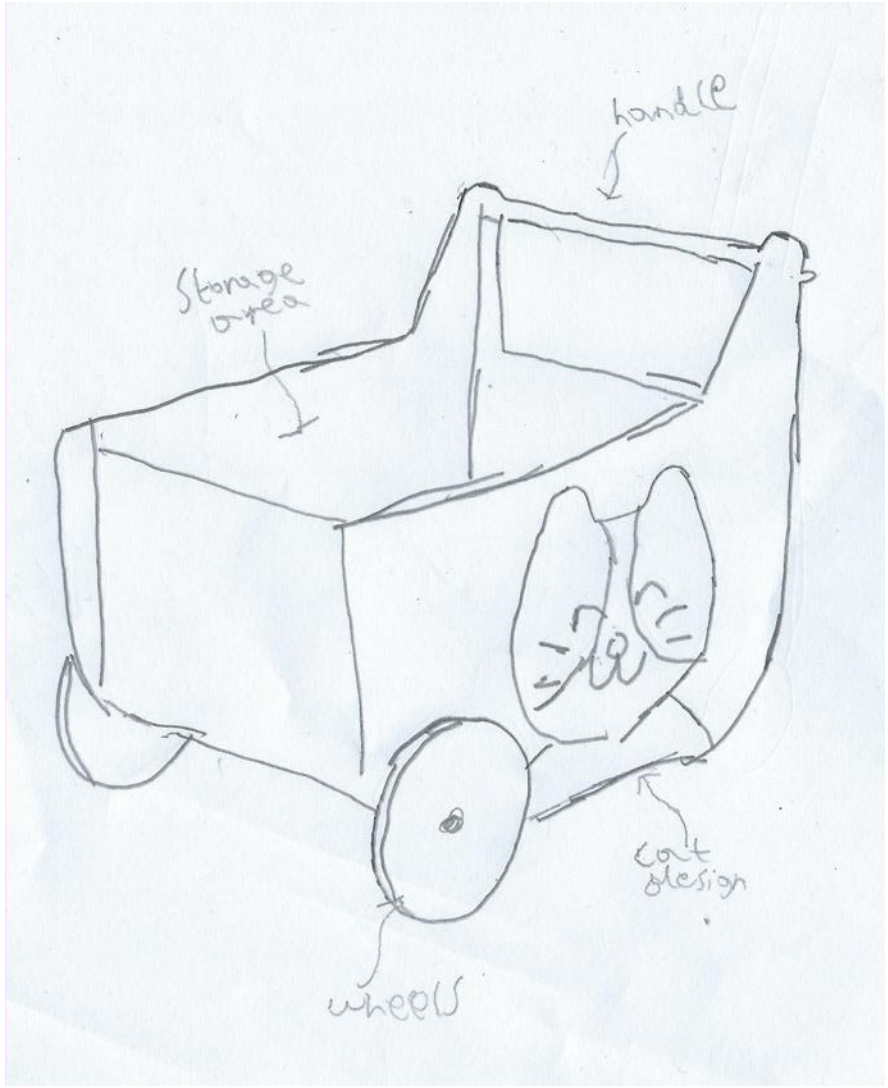
Design Idea 3b
I have adapted design idea 3a by making a 2 sided wooden board which is also foldable which allows it to fit into small places for e.g. cupboard, storage rooms. Aswell as this being space saving for my stakeholder it also has multiple educational features for my primary user.





2. Design Idea 4a and 4b

Audio 5
Transcript on slide 20



Design Idea 4a
This idea is a push able storage trolley which my primary user can pick up and push around.

It could help my primary user with their walking abilities.

This model is not easily cleanable as the storage area will get dusty and dirty easily.

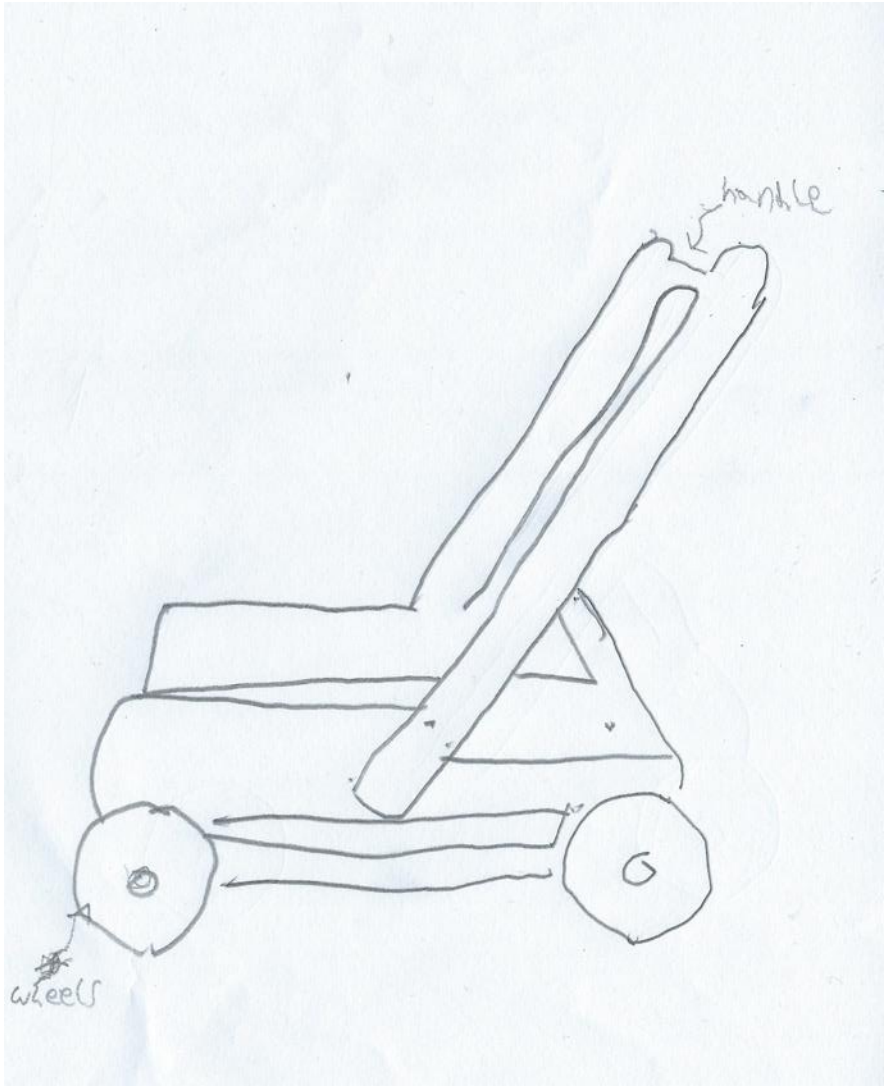
This toy may not be conveniently stored as it is quite large and an awkward shape .

Design Idea 4b
I have taken away the large storage area on this design.

This model could entertain pre school children but they may get bored after a while.

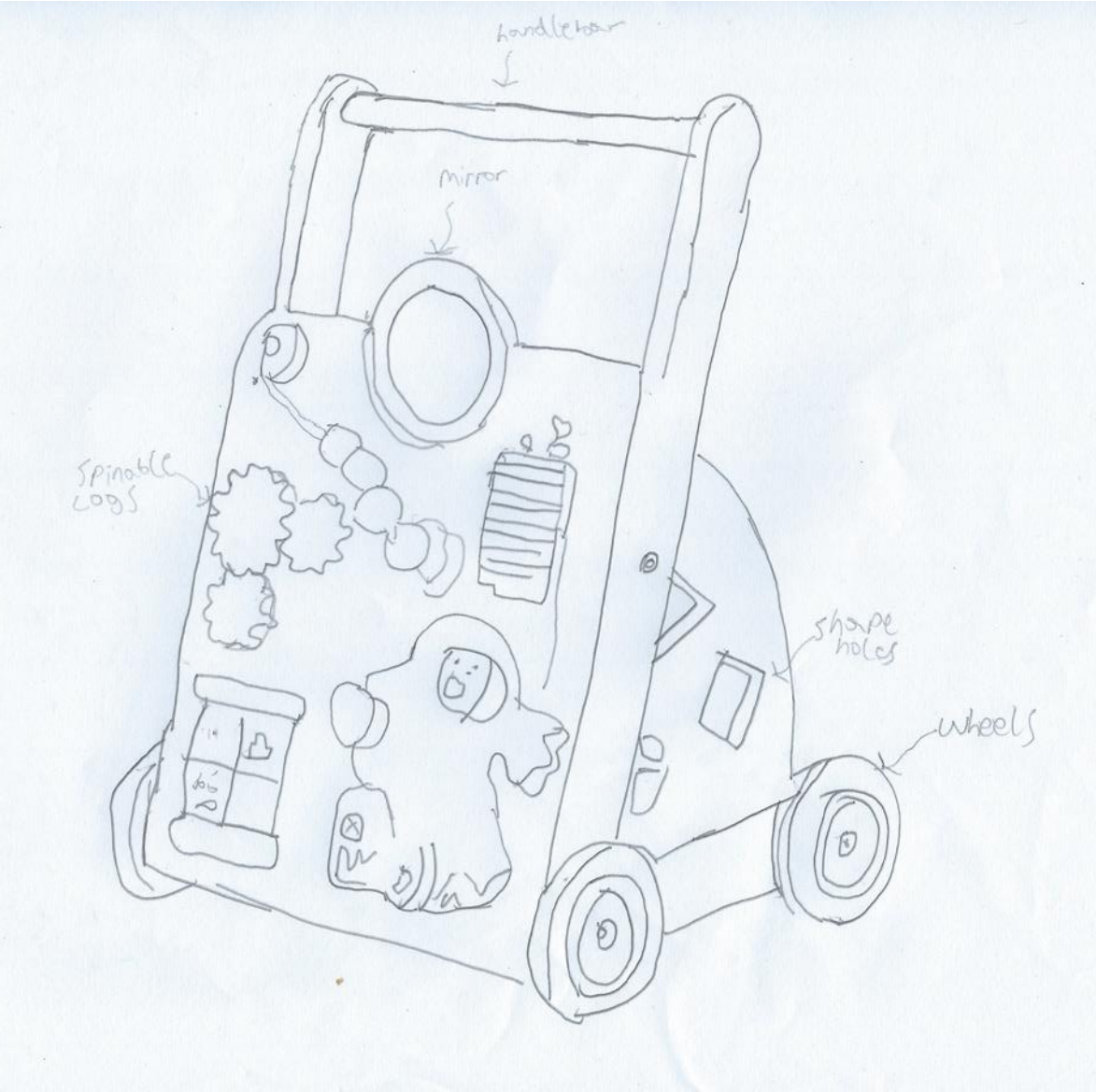
It doesn't have round corners which could possible result in an injury.

The components on this model are safe towards children because there is no small objects.



2.3 Development of design ideas into a chosen design

Audio 6
Transcript on slide 20



Design Idea 5

After listening to my stakeholders opinions I have produced design idea 5. It is a combination of all my previous design ideas I have taken features from the activity board and toolbox and combined them with the push along toys.

This toy would entertain my primary user as there is multiple entertaining features placed on the activity board.

Aswell as this toy being entertaining it is also educational because the features on the toy will help with pre school children's fine motor skills.

It will also help develop children's walking when they are pushing the toy around allowing them to walk assisted.

There are colours and shapes on the product which will catch pre school children's eyes.

This toy can be seen as long lasting since it is made securely with wood and plastic.

This toy may not be able to be conveniently stored since its an awkward shape and might not have the ability to be stacked onto another toy.

2.3 Development of design ideas into chosen design

I gathered all my tools to make my final model: scalpel, ruler , pencil corrugated cardboard trisquare.

I marked out the different parts for the model then cut it with the safety ruler and scalpel.

Then I used the scroll saw to cut out the wheels from plywood (health and safety: goggles, apron extraction.)

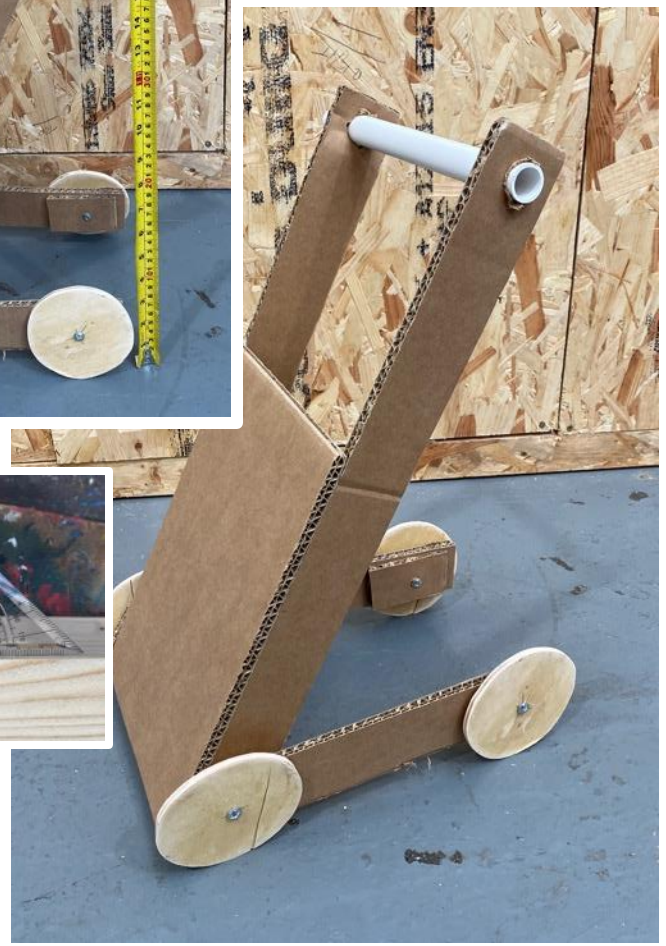
Then I sanded the wheels (health and safety: goggles, apron and extraction).

Then I marked the centre of the wheel and drilled the centre to create a hole.

I used a nut and bold to screw the wheel into place.

The height of my push along toy is 620mm.It is the perfect height for a 1-year-old to hold and push along I know this by ergonomics research.

The angle between the base and the front pane is 70mm.



2.3 Development of design ideas into chosen design

I started cutting my wood with the wood saw using a clamp to hold the wood down.

I then sanded my wood to curve the edges to prevent injuries.

Then I used the mitre saw to cut the side and bottom sections to size

I used pva glue to stick the wood together .

Then I used pliers to clip onto the wood and left it overnight for it to stick together.

I sanded my wood to round shapes and smoothen out the surface with a hand sander.

Then I cut the edges of my wood with a Tennon saw.

Then I marked the correct spot where to drill with the hand drill.

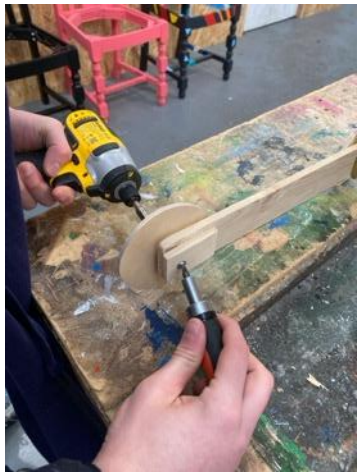
I drilled holes into the wood using a hand drill and clamp.

Then I used pva glue to stick the wood together.

2.3 Development of design ideas into chosen design

I started to carefully drill holes near the bottom of the toy with a hand drill for the wheels to slot in.

I sanded the toy with a hand sander to make the corners more rounded and smooth to prevent an injury from occurring.



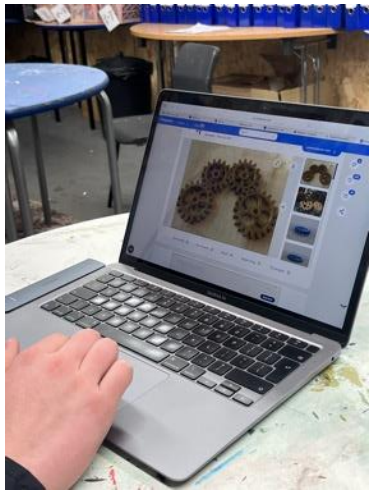
I slotted the wheel into place and tightened them with a nut and bolt, hand drill and a screwdriver.

The height of the handle is **620mm** from the ground. This is perfect for my user who is an average height of **750mm**. He will be able to put his arms out and push it comfortably.

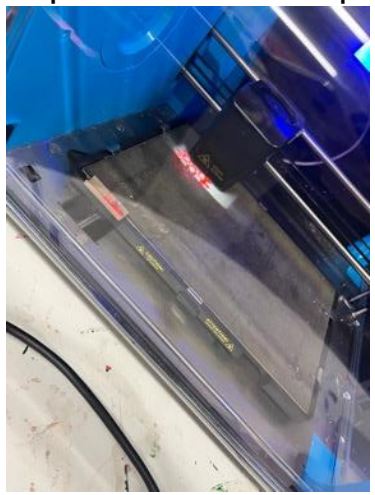
This is the final model. It has some features such as wheels and a handle for the child to push along . For me to improve this toy I could focus more on the wheels and make them more stable and screwed on tight.

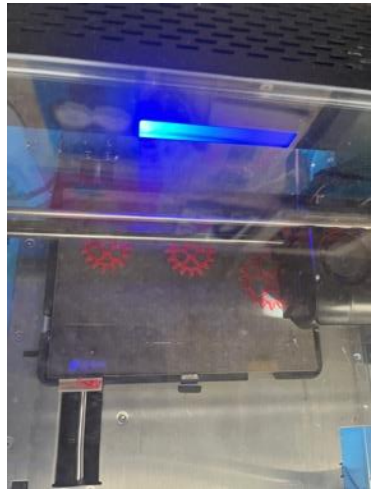
2.3 Development of design ideas into chosen design

I went on the computer and printed out the files for my cogs using a 3d printer.

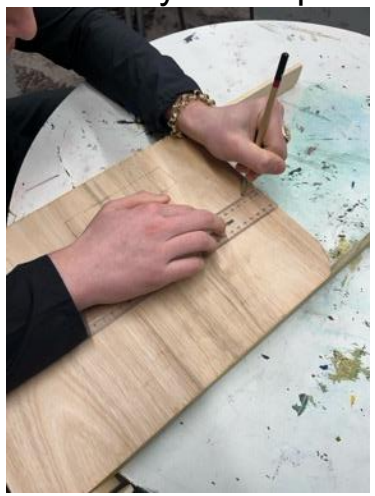


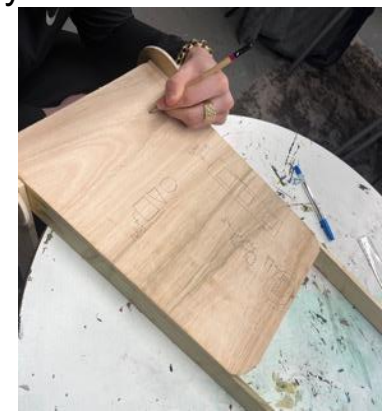
I sent the file from the CAD to the CAM. The CAM I am using here is the 3d printer. I loaded up the reel of ABS plastic and pressed print.





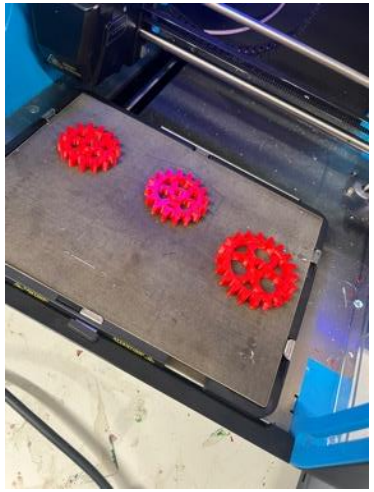
Then I used a ruler and a pencil to measure and mark out the activity ideas perfectly on my toy.



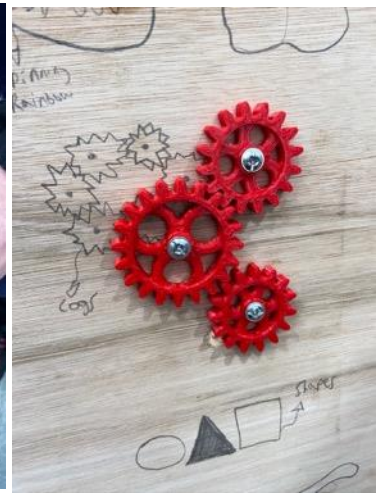


This is the model after drawing all of the activity ideas.

Here are the final 3 cogs printed in ABS plastic.



Lastly, I measured 3 small holes into the activity board part of my educational toy and screwed my cogs into them using a hand drill and screwdriver. They all rotate and when one is spun the other two spin with it .



To improve my final design, I could use some different colours or add a miniature handle onto my cog so my user can spin them easier.

2.3 Development of design ideas into chosen design

This model is for the top section of the activity board.

This will be a rotating mirror at the top. I rounded the corners using a sander.

I cut two pieces of pine to hold the dowell in place. I cut a rectangle out of plywood.

I cut a rectangle out of plywood. This is where the pine will spin.

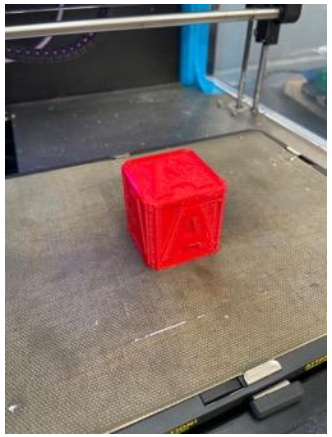
I used a pillar drill to drill a hole into both pieces of pine for my dowell to fit in to.

Here is the pine with both holes drilled in

Then I used a scroll saw to cut my dowell using goggles for safety.

I glued on my pine using pva wood glue and left it to stick overnight

I made a model for the spinning block section on my activity board, this is the frame being stuck together using pva glue.



This is my finished 3D printed block in red.

I drilled a hole into my 3D block so my dowel can fit through.

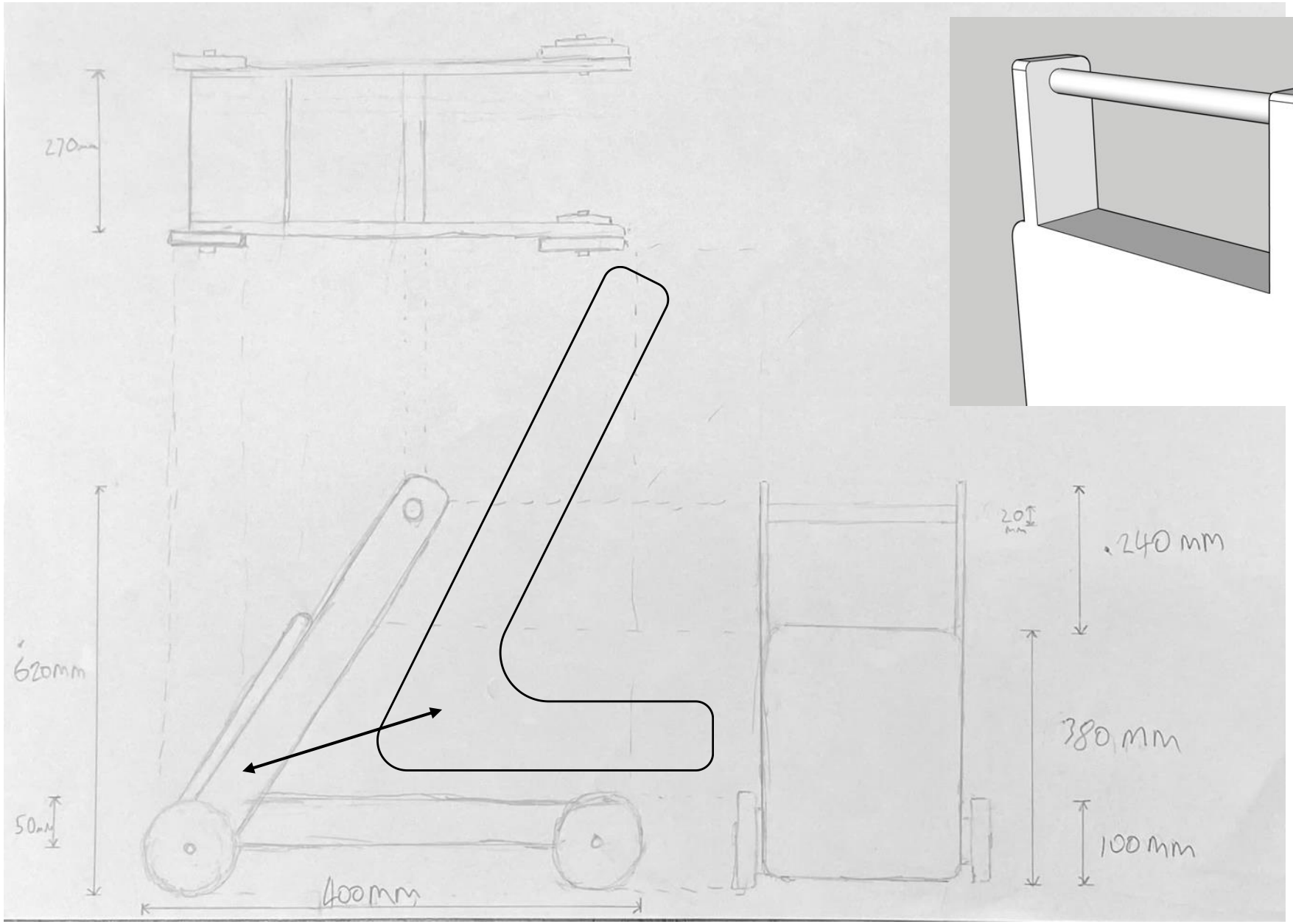
I then drilled small holes into each end of the frame so my dowel can slide through using a pillar drill and a chizzle.

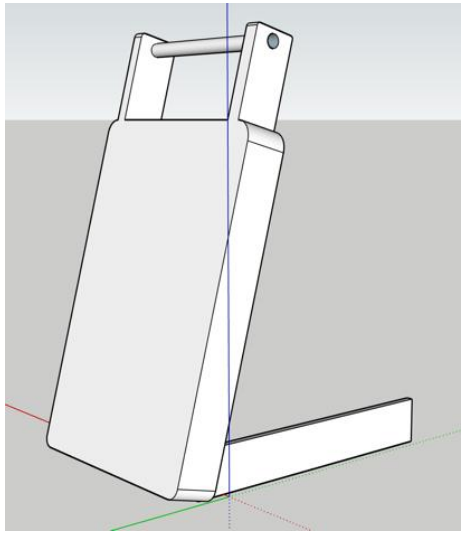
This is the finished model of my spinning block section. To improve for my final design the hole in the block needs to be slightly bigger to allow the blocks to spin more freely

The indented section for the dowel will need another of layer to stop the dowel from falling out.

A further improvement would be adding more blocks, more alphabetical letters and different colours for each block. I could also add numbers on the activity board.

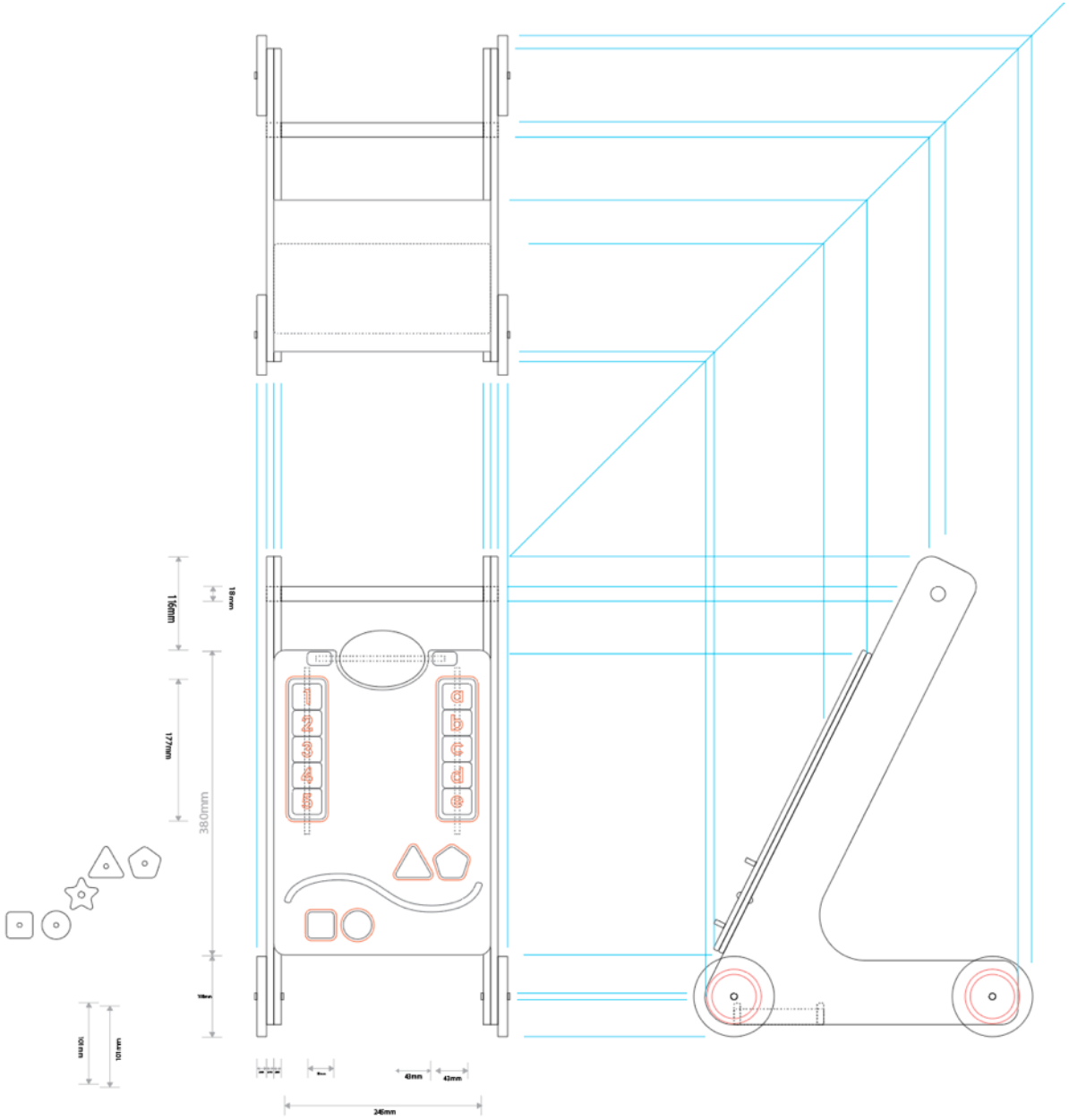
2.3 Development of design ideas into chosen design





To make it sturdier and use less material I am going to make the side panels and bottom section the same piece of material.

Working Drawing (CAD)

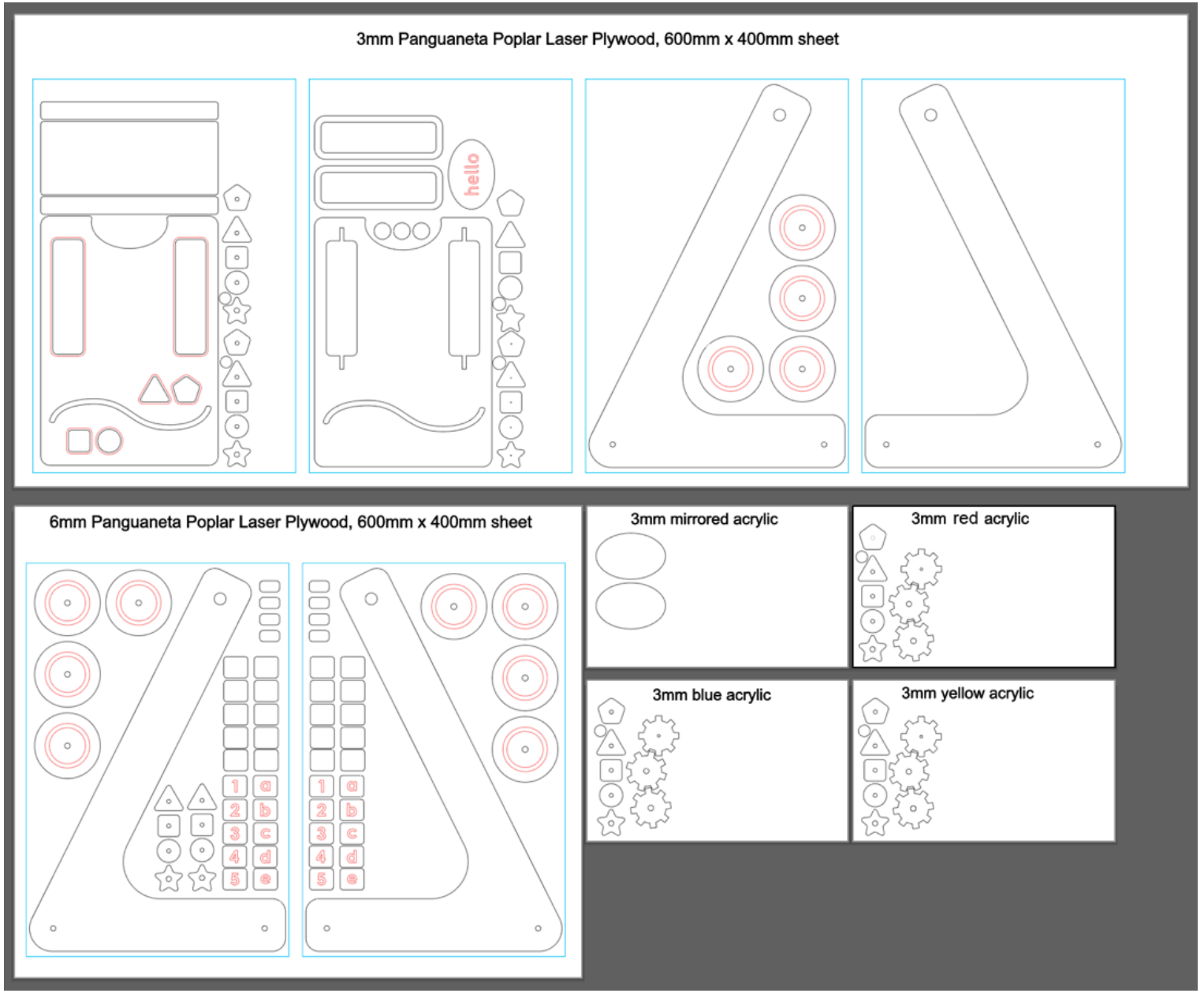


Review of chosen design

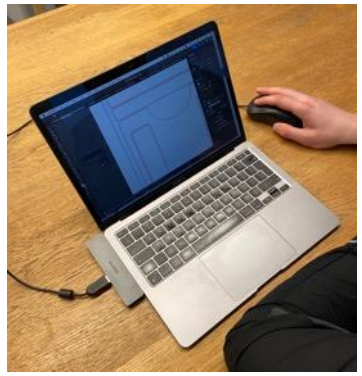
	Specification Point	Chosen design
Function	• To entertain pre school children. • To be educational so the children learn as they play. • To feature a combination of educational features such as letters numbers colors and shapes.	• Yes, my final design will incorporate features to entertain and educate my user. It will have numbers, colors , shapes etc.
Performance Requirement	• My product must be durable and long lasting. • Rounder corners to avoid injury.	• From the materials we have chosen to use for the final design, it will not be long lasting. • The corners are rounded to avoid injury.
User requirement	• Will be safe for children to use. • Suitable to be taken anywhere (portable). • Must be be conveniently stored when not in use. • Easily cleanable. • Good value for money.	This will be safe for pre school children to use . The size of this model is quite large and has an awkward shape so it may not be conveniently stored.
Materials and Compounds	• The main material I will be using is timbers and manufactured board's. • Needs to be sustainable and environmentally friendly. • Components must be safe (choking hazard for children). • Materials need to be high quality.	• The materials used on this model are sustainable and environmentally friendly. • If the components become loose it could be a choking hazard for children.
Aesthetic	• Bright, primary colors will be used to appeal to pre school children. • Any packaging or promotional material must be aesthetically pleasing.	• This final design is riddled with bright primary colors which will appeal school children.

Final Design CAD

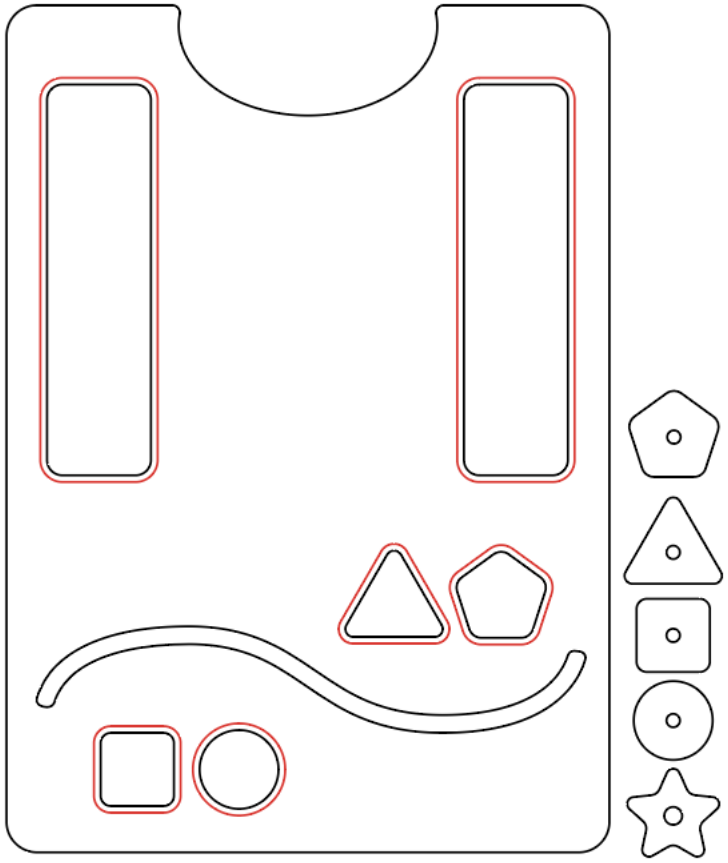
Here is my CAD file ready to be cut on the laser cutter. The tools I have been using are the shape, line and pen tool. The **black** lines indicate a cut, and the **red** lines indicate engrave. The **blue** lines are the outside of the material.

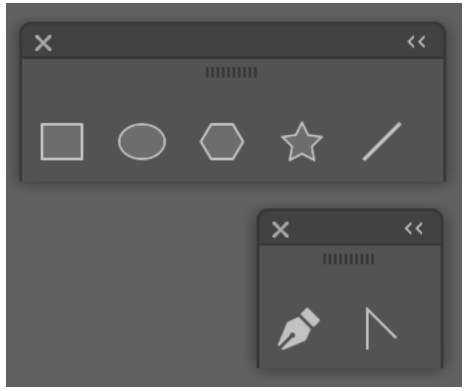


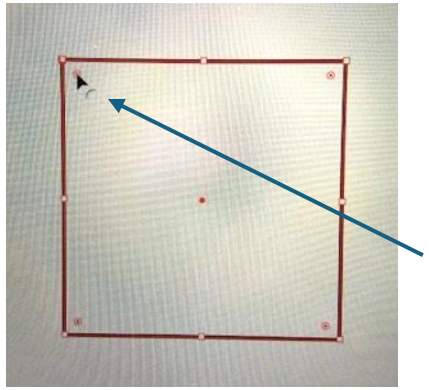
3.1b Manufacture – making diary



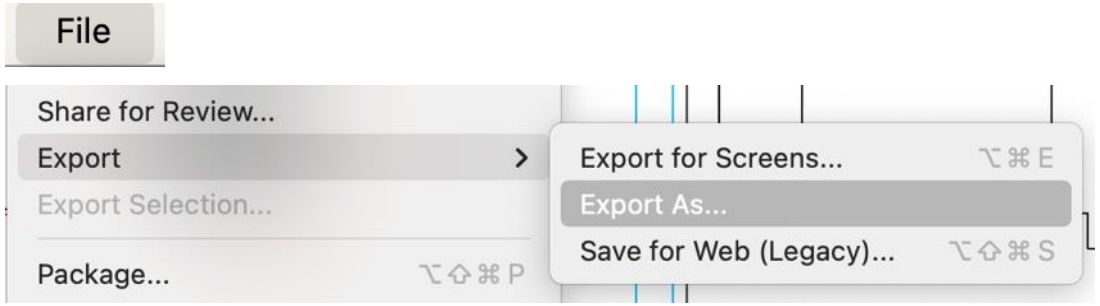
1. I used computer aided design (**CAD**) to draw out my pre school children's model. The files I create will be manufactured on a laser cutter. The tools I have been using are the shape, line and pen tool. The **black** lines indicate a cut, and the **red** lines indicate engrave.



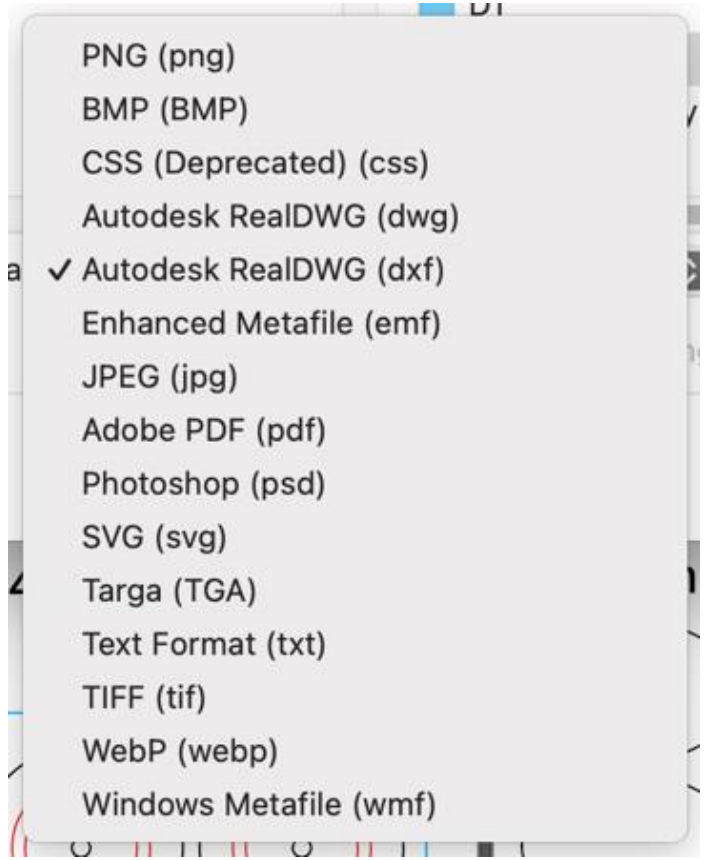




To ensure there was no sharp corners, I rounded them off with this tool here.



2. After drawing the files for my pre school children's model I had to export them as a **dxf file**. This is the recognised file type for the laser cutter.



3.1b Manufacture – making diary

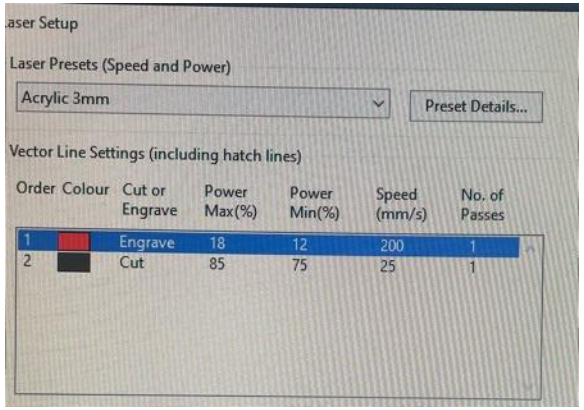
3. Laser Cutting (CAM)

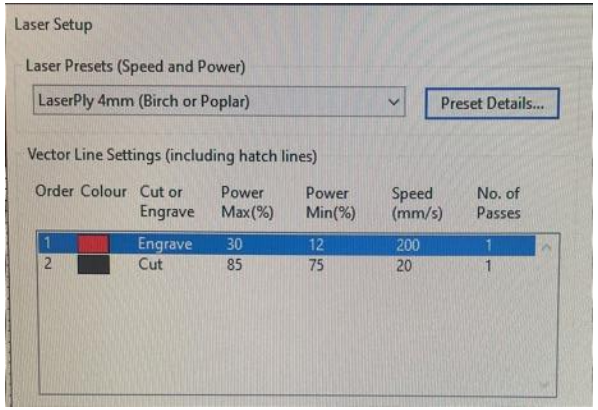
After drawing the CAD file and exporting it as a dxf file the technition then loaded the plywood into the laser cutter.

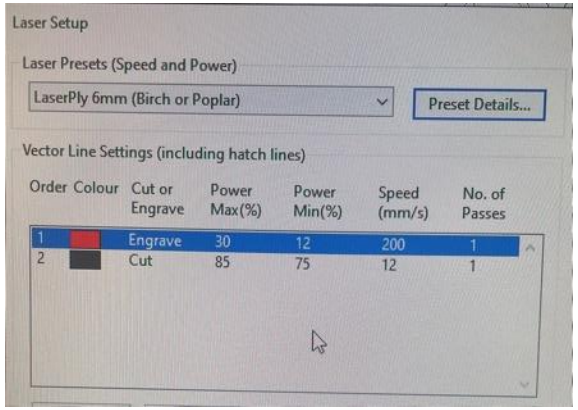
He adjusted the settings for the material to ensure the height, and the power of the laser were correct.

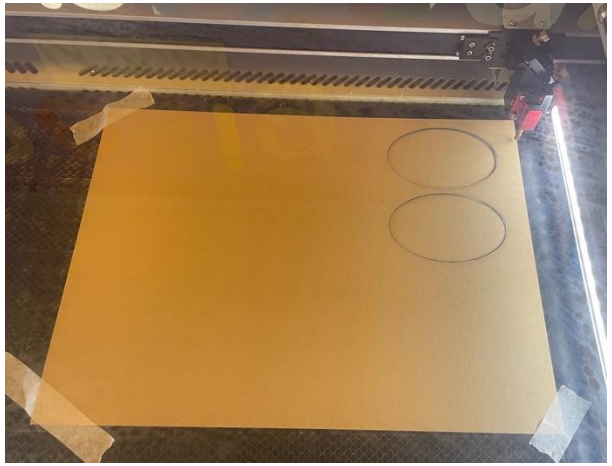
Before cutting, he pressed test to check the size of the file. He then turned on the extractor (for safety reasons).

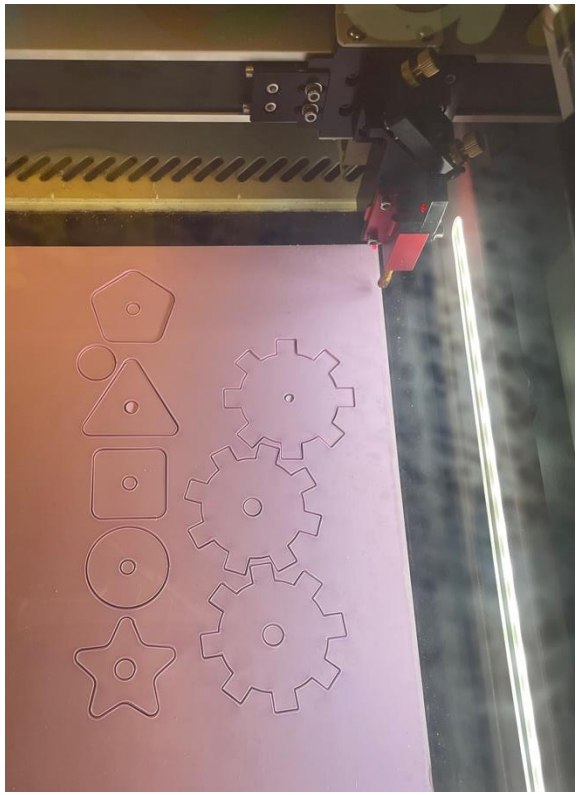
He pressed start and monitored the laser cutter cutting my material.











3.1b Manufacture – making diary

Here are my components that have been laser cut (Plywood and acrylic). For health and safety in the workshop, I put on my apron.

4. I used pva wood glue on my activity board. I stuck two 3mm pieces of plywood together.

I then used pva wood glue to stick a 3mm and a 6mm piece of plywood together. I avoided getting any glue near the sides.

3. This is the 240-grit sandpaper I used to sand the burn marks of my components.

I wrapped the sandpaper around a piece of wood to apply even pressure.

I wrapped masking tape over my two layers to make sure they are aligned and to ensure they don't slip.

This is me sanding away the burn marks off.

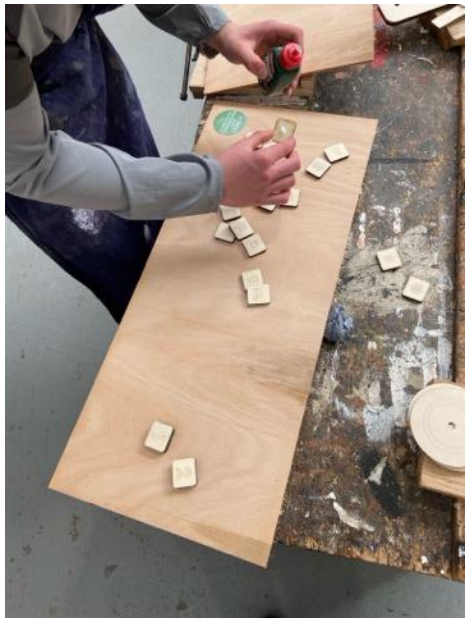
Finally, I placed multiple sheets of acrylic on top of my activity board and side panels. This was to apply pressure to ensure the glue bonds well. I left this for 24 hours.

I used a damp piece of blue roll to scrub of all the saw dust. I did this so I had a clean and smooth surface to glue on.

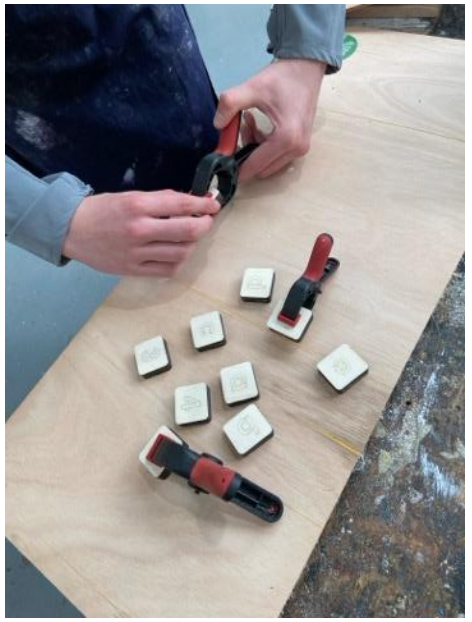
3.1b Manufacture – making diary

5. I used the 240-grit sandpaper to sand the burn marks of my spinning numbers and letters. I placed my sandpaper on the table and scrubbed my spinning blocks lightly in circular motions onto the sandpaper to fade the burn marks away. I tried to scrub as lightly as possible, so the numbers/letters do not fade.

After sanding my spinning blocks, I rubbed a piece of damp cloth over the top to remove any excess saw dust. I done this to get the surface as smooth as possible for later on when I glue the blocks together.



I then got some pva wood glue and stuck all the pieces together. I ensured not to use too much since the glue would have dripped out to the sides.

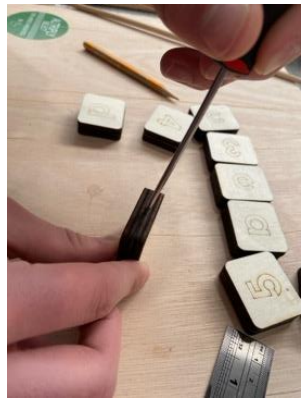


Finally, I clamped my spinning blocks together and left them to stick for 24 hours. This would guarantee the blocks to be perfectly sticked together and be fully dried the next morning.

3.1b Manufacture – making diary

6. I set up the pillar drill by using a hand clamp, scrap wood and a spirit level (to make sure its even). For health and safety, I wore an apron and goggles.

Then I measured 1.75mm on my blocks using a ruler and a pencil. This is where I will be drilling.



After marking my spinning blocks, I used a scribe to make a small hole directly on my pencil line.

This is the result after all the small holes were made.

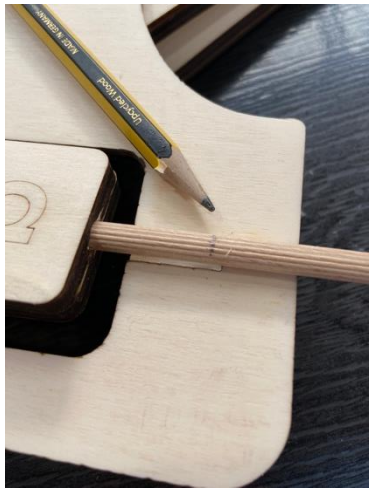
7. I then started drilling the holes using a pillar drill and some scrap wood. The scrap wood helps my spinning blocks stay even and sturdy while drilling.

This is me testing out the blocks on my dowel (checking if they spin properly etc.)

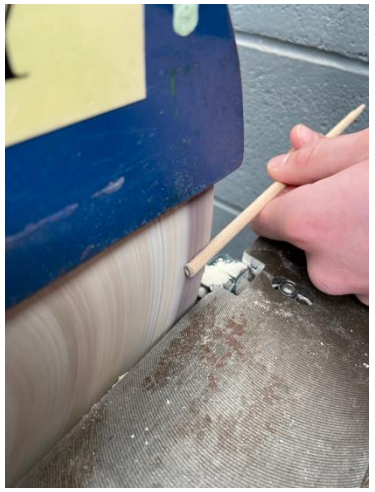
Lastly, for health and safety I cleaned up all the sawdust that has gathered while I was using the pillar drill using a dustpan and brush and a vacuum.

3.1b Manufacture – making diary

8. The dowel slots into the laser cut plywood but sticks up too far.

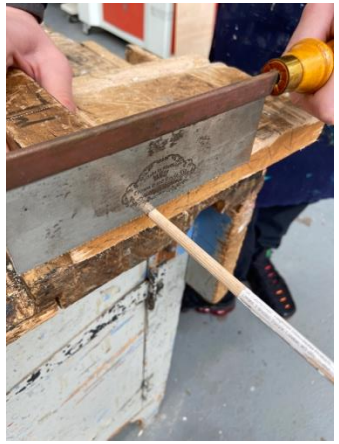


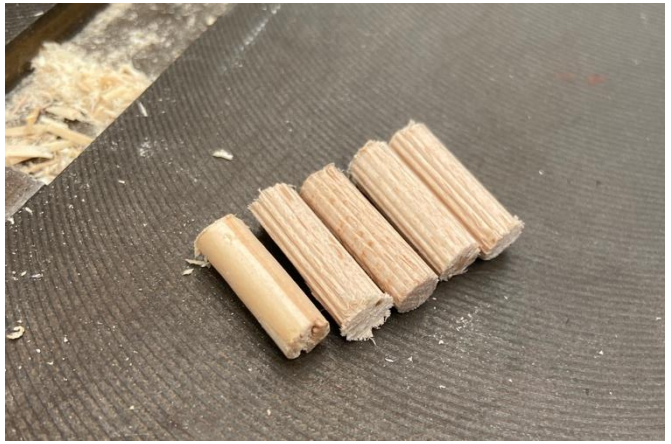
So, I marked up where to sand half of the dowel away.



Here I am using the disc sander to sand my dowel to the correct size.

Finally, here's the dowel sat in place after sanding.



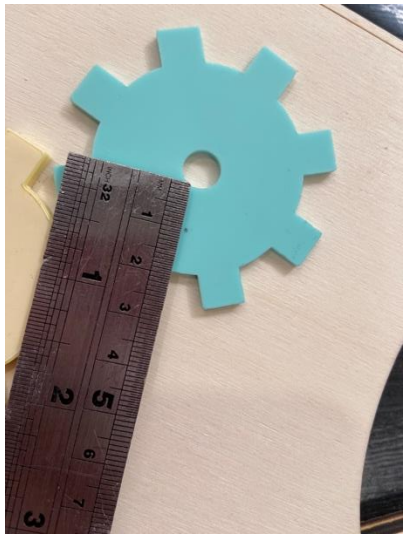


9. I marked and cut my dowel using a bench hook, a pencil and a tenon saw. These will be used as handles for my jigsaw shapes.

10. I used pva wood glue to stick together the 6mm wheels and I used a spring clamp to apply pressure. I left to dry overnight.

3.1b Manufacture – making diary

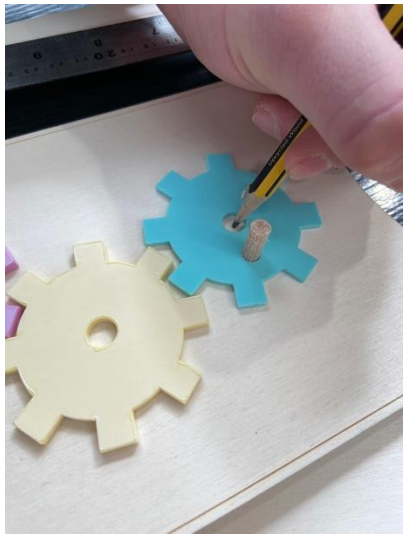
11. I peeled off the protective layer from the acrylic gears.



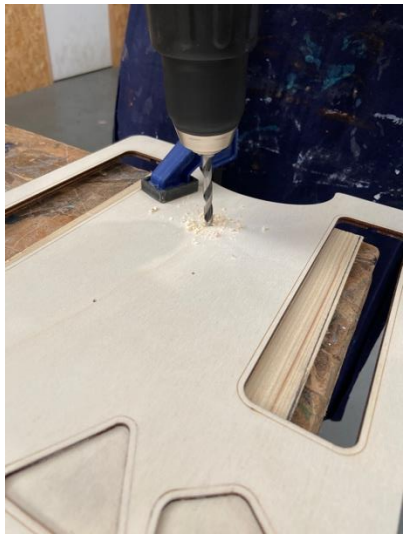
I measured the centre using a pencil, ruler and scribe.

Then I use a scribe to make a small ident to where I was going to be drilling.

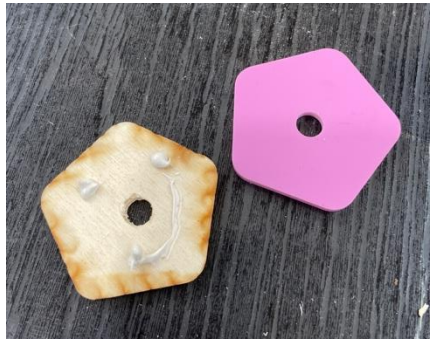
Then I proceeded to drill the hole using a 6mm drill bit.



I marked the centre of each gear on the activity board using a pencil.

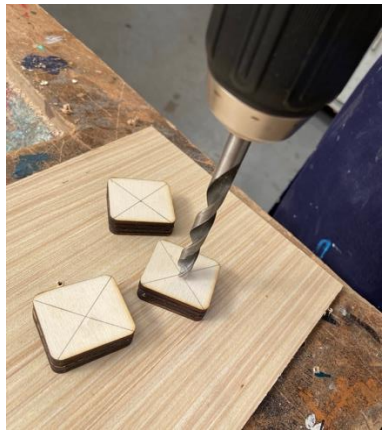


12. I drilled 8mm holes on the activity board for the gears to be fastened to.

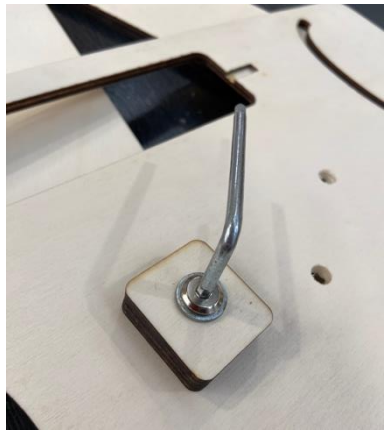


13. As I had different materials to stick together, I applied instant nails to various bits of acrylic and plywood. I put spring clamps on overnight to apply pressure.

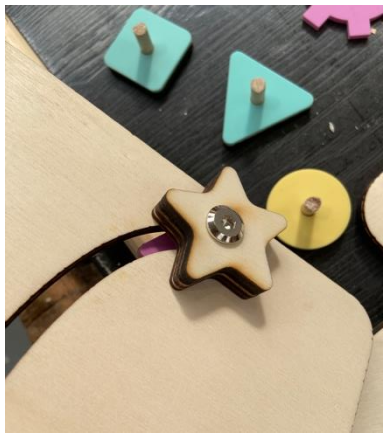
3.1b Manufacture – making diary



14. I marked the centre with a cross and drilled a 6mm hole in the centre.



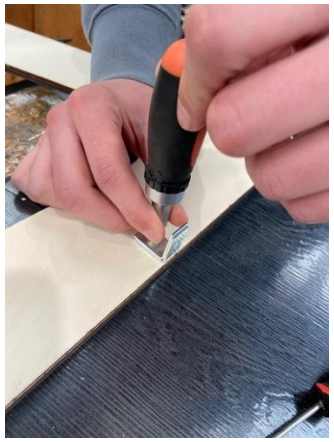
Then I used an allen key to tighten the screw for my wooden blocks. The wooden blocks fill the gap to ensure the gears and star are fixed in the correct position.



15. I used wet and dry cloth to remove the scratch marks on the acrylic mirror.

16. I tightened my blocks and mirror with a hand vice and drilled a 6mm hole with a pillar drill into each side. I used cardboard to stop the materials from scratching.

11. I used a ruler and Tri square to mark out where to put my L shaped bracket.



Then I carefully screwed them on using a ratchet screwdriver.

12. I couldn't use the little screws on the activity board because they would of went all the way through, so I had to use instant nails instead.

I also added a very thin line of pva wood glue around the edges.

I placed multiple spring clamps on the areas that have been glued and left them in place overnight.

Finally, I used pva glue and a clamp to attach the mirror on.

3.1b Manufacture – making diary

14. I marked the centre with a cross and drilled a 6mm hole in the centre.

Then I proceeded to cut my dowel with a mitre saw.

I started to glue the frame of my spinning block section with pva wood glue.

Then I placed spring clamps and weights to my activity board, so it sticks correctly.

I screwed my wheels together using a ratchet screwdriver.

Here is my final model. The wheels have been attached along with all the other components.

3.1b Manufacture – Final Prototype/Product

3.1b Manufacture – Final Prototype/Product

4. Evaluation – Primary user testing