

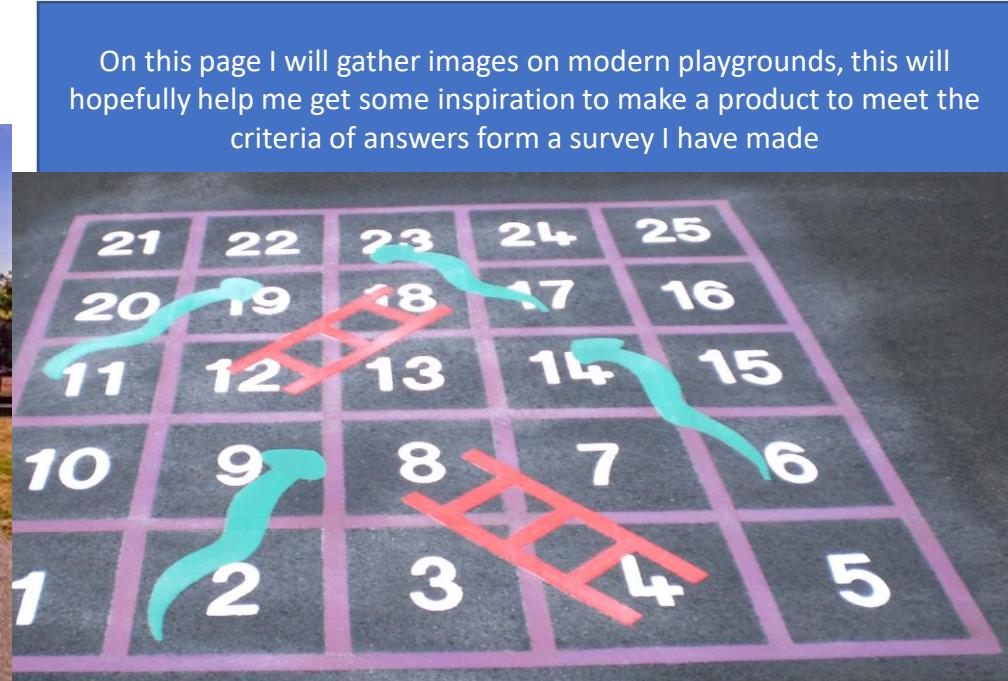
# C.A.T.

## Maya Issa

How can products be used to make play time in the primary school playground more fun and interactive?

# Relating products.

On this page I will gather images on modern playgrounds, this will hopefully help me get some inspiration to make a product to meet the criteria of answers form a survey I have made



# investigate

How can products be used to make play time in the primary school playground more fun and interactive?

## 1.1a: identify the needs of the end user

In this first section, I will consider the main problems of a playground to establish one main problem that I will answer , I will then set forth a solution to solve the problem. As playground fun only lasts a certain period of our childhood, I am determined to make a product that kids will enjoy during their recess time, and hopefully be remembered as part of their childhood . Children start to contribute in playground games from a very early stage , once they start walking , and actions taken on a playground help them develop learning skills. Although millions of children take part in playground fun every day, they may not be interacting with other children, so my product needs to focus highly on the interactive side of playtime. To correctly find and address a problem I have produced a few questions that must first be established.

- What age do children start to develop skills from the playground?
- What age do children stop playing in the playground?
- What is the most favourable game in the playground?
- What kind of games help children interact more?
- Why might children in a playground not interact with one another?
- What is the impact of recess of children?

The purpose of these questions is to identify a client type to base my product around and eventually identify a problem. The definition of fun changes according to the demographic and age of children in the playground. Or example while a 4-year-old might enjoy simple activity such as playing dolls or building blocks a more developed child around the age of 8 might enjoy more adventurous and harder games such as jump rope or rock climbing. To find an answer for these questions I conducted both online research and running a survey on my own, through survey monkey.

### Information collected through the internet

((info.thinkfun.com/stem-education/the-impact-of-recess-on-child-development)

The data that I have collected through the internet has helped me answer a few of the questions.

Recess impacts a lot of children and without recess a child can be affected dramatically.

Traditional studies ( The American Academy Of Paediatrics) indicate that action taken on the playground and traditional type play support physical and social developments of a child to a certain extent. Playgrounds have an important role in the modern's child's world. The ideal outdoor playground should be a replica of natural outdoor environment for today's urban child, they should encourage physical , social , emotional, mental and creative play as well. Playgrounds also need to allow children to interact with one another as this will affect their social capabilities from an early stage.

According to the CDC diagnoses of ADHD, obesity, depression and anxiety are all on the rise as the amount of time children are forced to sit in the classroom increases.

Therefore the product I make should be one that creates memories for children through their childhood while they still can run around during recess.

In his page I will be focusing on the main problems of a playground and I will also identify a need for a product that could solve the problem. This will help me produce a design that will answer the question. I will research what kind of games in recess help children interact more and develop learning skill which I should include in my product so that children can get the most out of playtime

### Benefits of recess

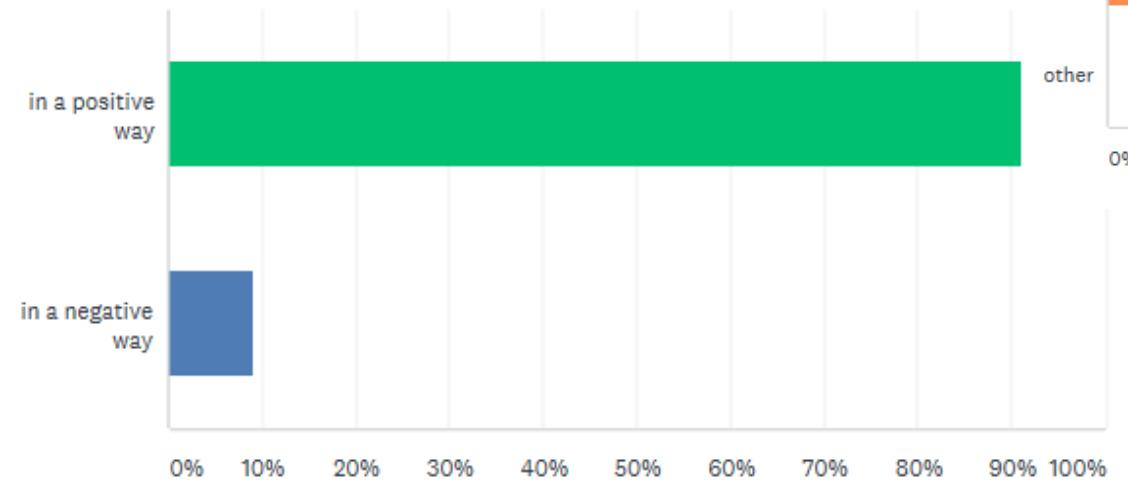
- Students are more on task during academic activities
- Have improved memory
- Are more focused
- Develop a greater number of neural connections
- Learn how to negotiate
- Find ways to demonstrate leadership
- Can teach their own games
- Learn to take turns
- Learn how to negotiate conflicts
- Leads to more physical activity outside of the school setting

As playtime impacts a lot of children's everyday life, I need to design a product that helps bring children together, and helps make their recess time as fun as possible



To better find a client, and more importantly a problem I conducted a survey that consists of open-end question about the environment of a playground and ways a playground can be improved, there was many patterns throughout the survey I saw that the mean age that people start to go to the playground is 4 years old, the playground has mostly positively impacted peoples social skills, and there favorite games where those that required interaction.as I asked mostly 15 year old's about their past experiences in a playground , I needed to make my results more reliable, so I took a visit to the pre prep playground and I interviewed children while they were playing.

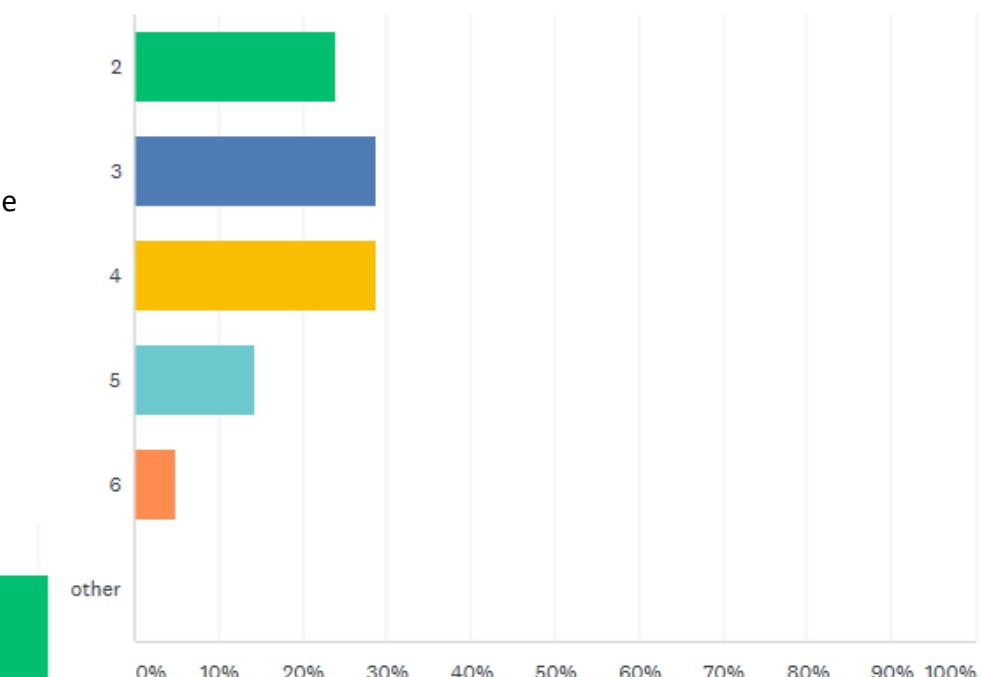
**Information I have gathered online from a survey:**  
How has playtime (recess) impacted your social skills?



### Conclusion from the interview and the survey.

Both the survey and interviewing the children has helped a lot with the research as it has drawn a bigger picture of the necessities I should include in my product. I need to make sure that my product includes a form of interactives, it needs to be suitable for the ages between 4-10 years old and should be for a group of children that it will end up having them bond together.it should mainly include interactive games and it is necessary that the finish look of the product is appealing to children's eyes (color).

### What age did you first start playing in the playground?



### Do you think recess has helped you develop learning skills?

Out of the 22 people that have answered my survey 100% of them answered that , yes recess has helped them develop learning skill

### The interview:1

Me: what is your favorite games to play in the playground?

Pre prep student: I really like to color with my friends, and I like to play in the kitchen.

Me: why is that your favorite thing to do during recess?

Pre prep student: because it fun and we can play together and make new friends with other people coloring.

On this page I will be identifying problems in playground products and I will also be using my survey answers to identify a client type for my product.

### What kind of games do you think will help children interact now a days?

Most of the answers where:

- Ball games
- Interactive games (like tag and man hunt)
- Jump rope
- And inclusive team games

### What age did you stop going to the playground?

The average age that people stop going to the playground vary from 9-12 years old

### The Interview: 2

Me: what is your favorite thing to do during recess?

Pe prep student: I like to play ball games and use the bicycles around the track.

Me: why is that your favorite thing?

Pre prep student: because I can race with my friends and we can laugh together

# Investigate

Before I can find a problem to solve, I need to identify a client type so that producing a question will be easier, I'm going to be interviewing both genders so I can see both of their perspectives of things, this will also help me develop an assessment of user needs and wants

## Market research and client profile

Before I can identify main problems found in a playground, I need to better understand what things my demographic (4-12-year old's) like so it can be easier to identify problems in a playground. I want to make my product available on a wide market not only in the region I am in.

### What are the monetary limitations on my demographic?

A school would usually be the one that buys the playground product, so my salary limitation depends on how much the school is willing to pay for my product, the price of a typical playground set varies from (\$490.99-1719.99) so it is crucial that my expenses remain under these restrictions.

### What does my demographic like?

To establish how the product should look, Including its tone and style, I must place myself inside the shoes of 4-12-year old's and establish a key list of things that would appeal to them.

Children usually like a lot of **bright colors**; I also need to make sure my product isn't **toxic** as children tend to put anything in their mouth. There also shouldn't be any **sharp edges** as children are still unaware of objects that can harm them, and they are still too young to take care of themselves. There is always supervision on a school playground however to reduce the amount of injuries I need to keep in mind the safety hazard, such as ones already listed.

Because there is a different age range in the playground, I need to dedicate the product towards a certain age, because every age is different to one another, so to make it easier I have designed a client profile for two different pre prep students and both are different genders so that their different interests can give me a design idea. I also created a client profile for both genders so that I can find a product that suits both sexes and enables them both to play together which the impact future generation as there will be more gender equality

## Mila



### Client profile 1

#### General interests.

Mila has an interest in art, she really likes to spend her lunch time doing art around a table with her friends

#### Occupation-description

Mila is a 5-year-old student in Abu Dhabi

#### location

She is a student in pre prep of Brighton college Abu Dhabi

#### Brief description of design requirement

Mila wants a new place to sit down and color in recess, she asks for it to be colorful and organized, and there must be enough space for 3 or more friends.

#### Why commission my product?

The table that Mila currently sits on to color does not appeal to her, it is disorganized and does not have much space for a group of friends so her interaction with other children during recess is low.

#### Cost limitation

As Mila is not going to be the one that purchases this product it just depends on how much the school wants to spend on my product. However The bench price limit should vary between £2000-3000

#### Other limitations

As far as possible the woods used should be used from sustainably managed forests, the product should include the colors pink and red, and should be child friendly (no sharp edges)

#### Time scale/ allocation

From 28 of September up to near of the end of march

#### Desired product outcome

Hexagonal bench, clean finish, polish and varnished. Sustainably made, organizing products that store pieces and pens along with paper

## Diego



### Client profile 2

#### General interests

Diego really enjoys ball games, and inclusive team games, he is competitive and really enjoys outdoor activities.

#### Occupation-description

He is a 5-year-old boy who lives in Abu Dhabi

#### Brief description of design requirement

Diego want a new product that enables him to interact with his friends competitively but also friendly, his school has a bicycle track ad he would really like making use of it.

#### Why commission my product?

Diego is getting tired of repeatedly playing the same game with his friends, he wants a new product that will make recess more fun .

#### Cost limitation

Diego usually plays with games such as the mini bicycle on the track , the average price of a mini bicycle usually costs £2000-3000 so it is crucial I stay with these expense restrictions

#### Other limitations.

As far as possible, materials used in this product should be sustainable, and I should try to avoid any sharp edges in the final product, he really likes blue and purple so I should try and include them in my product.

#### Time scale/allocation

I should start from September 28 up to the end of march

## Secondary client:



Here I will be interviewing the head of school that will be buying my product, this will help me better my research and understand what the school is specifically looking for in my product.

I have already gone through two client profiles of future possible users, however, to make my design more targeted with aims, I will be also asking the 'buyer' of my product (head of school) about what they are looking for specifically in my product and what they are willing to pay for it.

**Interviewer:** good evening sir, why are you interested in commissioning my product?

**Buyer:** well, the playground that we currently have in our school is out of date, and I can tell that the products that are in the playground no longer excite the children or satisfy them during break time. So I am willing to buy a new product that fits several age ranges so that the children can have a more fun and memorable breaktime.

**Interviewer:** what exactly are you looking for in the playground, what designs are you willing to buy from me?

**Buyer:** well, the girls and the boys both have opposite tastes and play completely different games during breaktime, so I am hoping to buy a product that both the girls and the boys will enjoy and hopefully interact more together. I have realized that the girls mostly play calmer games, such as sitting down on a bench and coloring, or playing with the playground equipment at a steady and calm pace, but they always continuously complain to their teachers about how irritating and unorganized the bench is. However the boys are the complete opposite, they really like to break a sweat during breaktime and use their muscle, they specifically enjoy any form of climbing or running. So what I'm really looking for is something such an upgraded bench that is organized and comfortable for any child to use, or some sort of interactive game that both the girls and boys can play together, but no matter what the product is I need it to be suitable to both genders, so that both can learn to play and cooperate together. And along with those points, I strictly need the product to be very safe for any child use, I am not willing to have children get injured from a product that is designed to help them have more fun, and the product also cannot contain any toxic wood treatments, as there are some children in the school who are allergic to specific chemicals and I would rather not make them sit out just because of their allergies, I want everyone in the playground to have fair play and to be 100% safe at all times.

**Interviewer:** and how much are you willing to pay for this product?

**Buyer:** well, as long as the product meets the criteria that I have just specified I am willing to pay around £2000-£3000, but the product needs to strictly follow all my aims that I have just pointed out and more importantly, the product needs to be safe for use.

**Interviewer:** is there anything specific that you want me to include in the product?

**Buyer:** well there is not anything specific I can think off, but I know for sure that the children have more fun in products that contain colors as it attracts them to it more, and it also somehow brings them joy, I'm not sure what specific colors the children would want, but I'm pretty sure they are more into bright and obnoxious colors.

**Interviewer:** is there anything else you want me to add or want me to make sure to include?

**Buyer:** not that I can think of, no.

**Interviewer:** alright, thank you for time, and I will try my hardest to impress you with my product.

**Buyer:** alright, thank you, excited to see the final piece.

### Summary from the interview:

- I need to produce a product that is suitable for both boys and girls.
- The product needs to follow health and safety regulations.
- The product should not include any toxic chemicals, (some children are allergic to the ingredients).
- The product should be organized.
- It should be comfortable for use.
- My time spent making the product should calculate to help me make a profit from the £2000-£3000

# Investigate

## Outline a design problem from the context provided

The main reason I went to my pre prep playground to find faults in the equipment, is so that I can get a bigger idea of what is really needed on the playground , so that I can develop the playground instead of not having an impact on it. And by seeing faults of a playground nowadays I can know what I need to fix and include in my product

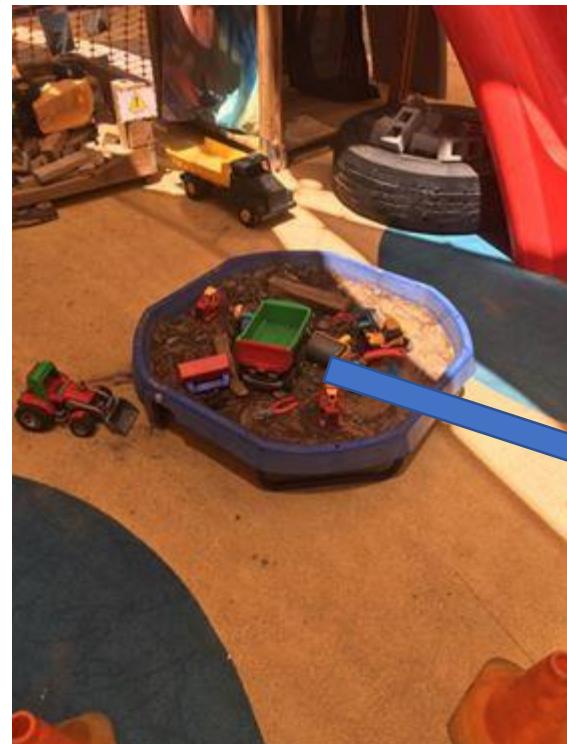
The first thing I saw in the playground was the grey track, it seemed like a convenient and fun way for kids to apply their love for racing into a real-life scenario.

However the bikes that came with the track did not seem as appealing, they looked rusted and seemed as though the wheels would not be able to hold the weight of a child.

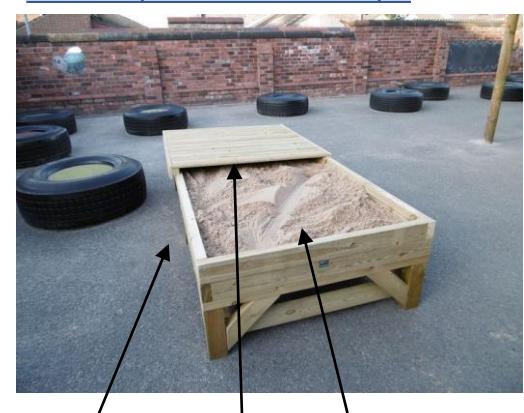
Products that I can make to improve these faults:

The bicycle can be improved, for example there can be a main base wood, then layers of different size wood that all join up to make a shape (an animal, nature sort or just a bicycle) and there will be 4 wheels attached to the bottom of the bicycle

The different layers of wood will make the bicycle more durable to different weights as the weight of the child will be spread through the different layers of wood.



An example of a safer sandpit



sand pit is at a higher level

Bigger surface area

Keeps the sand safe in different weather conditions, so there is no sandstorm taking place on a playground

On this page I will be going through problems in designs already made, for this I had visited the pre prep playground to identify faults that can be fixed, this is convenient as the pre prep playground is where children from ages 2-5 play , so it fit my client type and also gave me some inspiration for some initial ideas

This is a sand pit, there are many problems within this product Because there is a small surface area for children to play in the sand , it can end up being crowded which can result in many things

- Children can be unaware of their surrounding and can end up throwing sand everywhere which can end up in children's eyes or mouth which is not a very safe concept.
- The sand is on a low level so children need to sit down while playing with the sand which limits their movement and can also mean that the sand can cause unnecessary mess
- There is no guard around the pool that contains the sand so the sand will end up everywhere and if the weather is windy the sand will flow out of the pool and potentially into children's eyes.

There are manways in which the sand pit can be improved:

- The pit should be at a higher lever (around shoulder length of the children)to avoid any injuries including sand.
- There should be a bigger surface area for the sand pit to be placed in , so that the children can have personal space and can also avoid injuring each other
- There should be a gaurd around the sand pit so that the sand stays in the pit and does not flow outside the pit

## Outline a design problem from context provided

This is supposedly meant to be a role play kitchen , but it barely looks like one.

there are no main big faults in this product it just contains many smalls problems that can be fixed, I think the lack of colour makes it less appealing to children as to them it would just look like a wooden box but those faults will help me be aware of any faults I can make in my final project.

The 'cutlery' does not seem convenient , they are basically just old bowls that have once been used for arts and crafts

*This can simply be improved by just switching out those old bowls for more modern kitchen play cutlery*

The sink area seems more reasonable but doesn't look very appealing to a child's eye, there is no pop of colour , just simply finished wood, and it just looks like a box with a hole cut out of it.

His product can be improved by adding some colour to the product, it is not a drastic change, but little things will make a difference, the design can also be changed , for example adding kitchen drawers cup holder etc so it looks more like a kitchen and makes it more appealing to a child's eye,

There are also a lot of sharp edges which is dangerous considering that 2-5-year-old play in this playground and are still unaware of things that can injure them  
*This product can be improved by rounding the edges, you can simply sand or file the edges to give it a softer finish*



on this page I will be going through problems in designs already made, for this I had visited the pre prep playground to identify faults that can be fixed, this as convenient as the pre prep playground is where children from ages 2-5 play , so it fit my client type and also gave me some inspiration for some initial ideas

The main problem with this table is the square edges that a child can easily bump into and cause an injury, it also lacks attention due to its dullness

This fault can easily be fixed by rounding the table and adding some colour even if it is just blue

An example of a more suitable play kitchen:



There are touches of colour which already makes the design seem more appealing than the one my pre prep playground

More uses available in the kitchen making it more fun and suitable for children to play in during recess

The exemplar kitchen compared to the kitchen in the pre prep playground look more appropriate and suitable for the children it contains colour, suitable cutlery and various areas, which would make it more appealing to the childrens eyes, by recognising these faults I should keep them in mind while I am making my product.

Various areas in the kitchen such as the sink, oven, fridge , making the set more fun to play with,

The 'cutlery' looks more realistic and appropriate for children.

## outline a design problem from context provided

This is a hexagonal bench where kids usually like to sit and colour. Again this designs reasonable but not for younger children, again there is not one big problem but just many small ones.

The bench contains sharp edges which could injure children while they try to sit down

**This can be improved by** rounding the bench, placing plastic covers on the edge to avoid injury or just sanding the edges

The table is very unorganised, and the pots are very unappealing as they are just planting pots

**This can be improved by making colourful organising pots instead of the planting pots along with paper holders, so the tale remains its tidiness**

The crayons and colouring pens are toxic, so teacher supervision is required at all time

By outlining problems in an existing playground I was able to make a list of things I should avoid and what I should keep in mind while making the product

- Should not have Sharp edges
- Should be appealing to a child's eye ( contain colour)
- Should be modern and appropriate (contain suitable uses)
- Should be safe (toxicity)



on this page I will be going through problems in designs already made, for this I had visited the pre prep playground to identify faults that can be fixed, this as convenient as the pre prep playground is where children from ages 2-5 play , so it fit my client type and also gave me some inspiration for some initial ideas

An example of a more suitable colouring bench:



This is a more ideal bench, it is still the same kind of design, but it is safer,

- the edges are rounded
- There are spaces in the middle making it easier for the child to take a seat instead of climbing over the bench.



These organising pots can be used instead of what is currently used, it looks much more appealing, and would help maintain tidiness.

# Investigate

## Investigating existing products

### Existing product no.1

This is known as the rhythm group of 3 playset



This product is found in:  
[Playgroundequipment.com](http://Playgroundequipment.com)

### Component measurement:

Large marimba : 73" x 26" x 30"

Bongo drums: 17" x 17" x 33"

Glockenspiel: 24" x 12" x 36"

#### Form:

This is a safe (rounded edges) and good-looking music playset however it lacks colour.

#### Scale of production:

This product would be industrially produced because of the manufacture of goods in the factory. because of the use of polyethylene it means that not much manpower is needed, this has a positive impact on the industry as there will be less low skilled job and this will help the economy be more moderate,(however smaller structured work with the timber for the small piece means that skilled workers will be needed so the pieces come out as desired.

#### Cost:

Large marimba: \$2,580.00

Bongo drums: \$990.00

Glockenspiel: \$1,110.00

Total: £3822

### DISADVANTAGES

- Causes greenhouse gases and toxic while producing
- Polyethylene requires a lot of energy to heat and cool, so it contributes to environmental degradation.
- Manufactured in America so transportation produce greenhouse gases

### ADVANTAGES

- Made from recycled plastics
- Adapted to user needs (interactive and fun)
- Mostly made in factories so it does not need high skilled workers
- For outdoor and indoor uses
- Industrially produced
- Less lo skilled jobs because of factory work
- For a wide variety of ages

User response: I think that this playset is fun and me and my friends will have a lot of fun with it, but I wish there was just some colour because its brown and brown is an ugly colour and unattractive.

I wanted to find out if any products on the market helped children interact more during recess (make it easier to make friends). I saw that many playgrounds already designed, made sure to include a lot of colour in their final product. For example: a designer called **Yinka Ilori** designed a playground using Pinterest's most pinned colours.so my main aim on the next few pages is to see what designers mostly focus on during their designing stage.

#### Material:

The playset components are made from high-quality metal, plastic ,timber and recycled plastic. They are specifically made from durable timber which can handle outdoor weather conditions, which is very reasonable because it means it will fit into any playground around the world despite weather conditions. The marimba and the bongo drums contain polyethylene which is a very commonly used plastic and is durable for its uses

The playground is built for outdoor and indoor uses, so it is more considerate to countries with different weather conditions.

#### Function and components:

This product is created to teach children the joy of music from a young age, the final piece is 3 main products each with a unique touch and sound and the use of all three help make children playtime more fun. The products and be placed inside or outside and can be stalled anywhere you need to put them.

On this page I am going to conduct research on existing products, I am going to critique products made by designers and evaluate their faults so that once I am onto making my final product, I have a bigger picture of the priorities needed to be included.

### User Requirement:

This product can be used by children from the age of 2-12 years old (as said on their website) it is specifically made for children who are capable of walking and standing up independently.it has different variety of instruments which will make it enjoyable for children the main aim of this product is to teach children the enjoyment of musical creation.

### Sustainability:

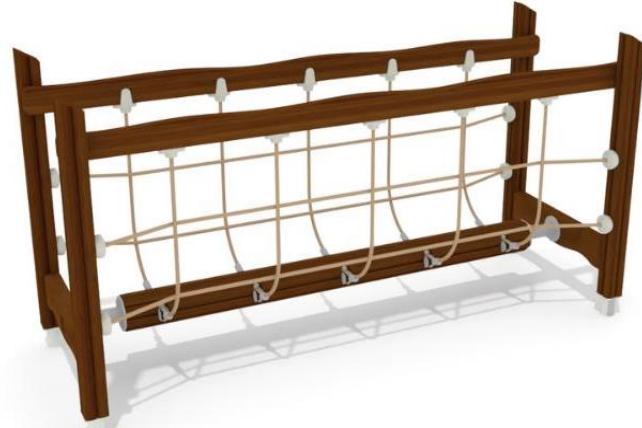
this product is manufactured in America, but they sell worldwide, meaning that there will be a lot of environment costs for its Transportaion, greenhouse gases will also be produced from the Transporation which is bad for the environment. The bongo drums are made from recycled plastics which is so it has positive impacts on the environment and less carbon dioxide will be produced. The Glockenspiel is made from polyethylene mallets which is made from the polymerization of ethylene. Polyethylene is named the second most dangerous plastic in the world, It is still derived from petroleum, and so secondary health and environmental risks from production of HDPE, as well as the limited amount that gets recycle, are still a big consideration, polyethylene requires a lot of water and energy to heat and cool its fibres and because of its large quantities, it contributes to environmental degradation. The large marimba is made from mallets and recycled plastics which has a better impact on the environment than the other products.

I personally think that this design is Innovatie and I could inspire a different design out of the product. I like how this product has different musical features and its main aim is to inspire young children with the creation of music, however the colour isn't appealing to our demographic as it is very plain and subtle while children are more attracted to colourful things, but its function might distract the children from its appearance. The **price** is between the price limit, it has a lot of functions and so I think for its price it is acceptable, however it is not a playground essential and it costs a lot s I'm not sure if the buyer will think it is worth it. (unlike essential such as; slide, swing ,sand pit ,kitchen playset etc)

# Investigate

## Investigating existing products

This product can be found in <https://www.lappset.com/Products/Product-search/LUMBERJACKS-BRIDGE/175536>



*Existing product no.2*

*This is known as the Lumberjack bridge*

### **Sustainability:**

Overall this company is very sustainable. they use PEFC certified northern pine which is ecological. Pine is both an economically and ecologically sustainable material and its life span can last up to 10-20 years. As long as it is used in the correct manner. Pine also has a negative footprint, so the company ensures to use woods felled from certified forests which mean that the material is guaranteed to be ecological produced. However this company manufactures its products in Finland and ships worldwide , so carbon footprint will increase as well as the release of greenhouse gases through transportation.

### **Form:**

This is safe as it has a rounded beam that helps guide layers across the bridge with or without the use of handrails.

### **User requirement:**

This product is specifically designed for children at the age of 3 and above, as it requires children to be able to walk and balance to avoid injury.

### **Scale of production:**

This product is mainly made of timber and it has smaller structure that need to be hand crafted so man power is vital a gig can be used for the 4 main stands to ensure that are pieces are the same sizes and length, but the smaller structure such as the ropes and the joints to ensure that all the parts are securely adjusted,. Because this is a low skilled job, meaning the price should be lower.

### **Function and component:**

The objective of this product is to improve balance, coordination, body and core strength. Kids can use this product and their imagination to have fun, (I.e. imagine they are pirates)

### **Cost:**

**£500**

### **Material:**

The lumberjack is mainly made of timbers , metal , rope.

The primary material is northern pine wood which has been pressure treated with a metal-based solution and surface treated to give it a brown colour. Because it is glue laminated, it does not suffer from moisture, so it does not bend or crack over time despite weather conditions, due to pressure treating the product lasts even in the most challenging weather conditions, shimmer coating gives the wood an extra protection against sun's ultraviolet radiation and against blue stains. So this product is guaranteed to last a long time. Northern pine. The northern pine has always been exposed to four changing seasons and weather conditions shifting from one extreme to another. Pine is a natural and soft material for children. It remains pleasant to use in any weather conditions, because it does not get hot in the sun or freeze in the cold.

the metal parts are made of low carbon steel which is a very structural steel and is suitable for outdoors.( Metal parts are grey)

The rope and nets are steel reinforced, the cruciform joints are made of stainless steel, the rope fasteners are made of strong plastic.(colour or ropes and net are beige)

All bases are made of steel, so it shelters the wood from direct contact with the ground to prevent rot and extend the products lifespan.

### **Colour and look:**

Because this product is surface treated , its finish look is a brown colour, the ropes are beige and the metal parts are grey so the finished look is quite dull, however the company gives you an option to customise the product where you can change the colours. Their colour options are;

**Wooden posts and beams;** brown, grey, dark brown

**Ropes and nets;** black, grey , beige, red, blue, yellow

**Lapp coat treated steel;** blue and dark grey

**Metal parts;** grey shimmer

### **Component measurement:**

Product length, 2490mm

Product width, 890mm

Product height, 1300mm

Falling space, 18.2m<sup>2</sup>

### **DISAVANTAGES**

- Transportation can cause an increase in carbon footprint and release greenhouse gases

### **ADVANTAGES**

- Company is environmentally friendly
- Timers are from certified forests
- Can customise to add colour
- sustainable
- Has a good objective
- Suitable for outdoor use and any weather condition

User comments: I think that this is a very fun product an me and my friends will have fun playing with it, I also really like how you can change the colour, and how it is sustainable. I think me and my friends will enjoy it because we can pretend like we are pirates

On this page I am going to conduct research on products that already exist, I will be critiquing these products and finding problems in them so that when I am up to designing a product I will know what faults to avoid, this will also help inspire me with product designs.

I personally think that this is a bright idea, I really like the background of this product and how the company is very sustainable with all the materials they use, I also like how you can customise the colour, even though it adds to the price, I think it's an innovative idea. the cost is also very ideal for this product and below **price limit** which is great, however kids under the age of 4 may be unstable and fall, so we need to ensure that the playground floor is soft and child friendly.

# Investigate

## Investigating existing products



### *Existing product no. 3*

This is known as the **play planetarium**.

## **Sustainability:**

Overall this company is very sustainable, they use wood from only certified forests and all metal and plastics they use are recycled, however this product is only sold on their website which is associated in Finland, so shipping will cause a release in greenhouse gases which is not sustainable.

## **Cost:**

**£23250**

## **DISADVANTAGE**

- Cost is above limit
- Transportation causes carbon footprint increase

## **ADVANTAGE**

- Has a variety of uses
- Provide learning ability
- For a variety of ages
- Mostly sustainable

User comment: I really like this product and I think it's so cool, me and my friends are going to have a lot of fun in it

## **Form:**

The play planetarium is a unique play and learning environment that can fit a numerous amount of kids at once which is perfect for recess. The dome shape consists of eight different climbing functions such as nets, ladders and climbing wall.

On this page I am going to conduct research on products that already exist, I will be critiquing these products and finding problems in them so that when I am up to designing a product I will know what faults to avoid, this will also help inspire me with product designs.

## **User requirement:**

On the website it claims that the user age is 1 year old and above, however I think that it should be for children above the age of 3, because the dome might be slippery and requires children to have coordination and strength.

## **Scale of production:**

This product would be industrially produced because of the use of goods in the factory, because of the use of polyethylene it means that not much manpower is required

## **Component measurement:**

**IMPACT AREA, M<sup>2</sup>** : 44.9  
**IMPACT AREA LENGTH, MM** :9020  
**IMPACT AREA WIDTH, MM** :9020  
**FALLING SPACE, M<sup>2</sup>** :61.3  
**FALLING SPACE LENGTH, MM** :9020  
**FALLING SPACE WIDTH, MM** :9020  
**PRODUCT LENGTH, MM** :4820

## **Material:**

The wooden beams are made of curved and glue laminated timber of pine, the wooden surfaces are coated with outdoor/ street furniture treatment solution so that the product is durable to outdoor condition and the wood does not suffer for moisture, so it does not end up splitting or cracking over time., the base is also made of pine and it is shimmer coated and varnished. The dome panels are made of high-density polyethylene (HDPE).the metal parts are made of low steel carbon and are Lapp coat surface treated making sure that the metal doesn't rust, and it also becomes durable for any weather condition, so the metal doesn't become too hot in the summer or too cold in winter. The climbing grips are pressed sand stone rock which offer an authentic rock feel and never become slippery. The nets are coated steel cables and the foundation metals are hot-dipgalvanised steel.

## **Function and component:**

### **Colour:**

Because the product undergoes treatment, its finished look is usually blank however you can customize colours and choose whatever colour you would like through their website  
**Wooden posts:** beige  
**Metal parts:** white  
**Wall parts:** black  
**Ropes and nets:** chain black

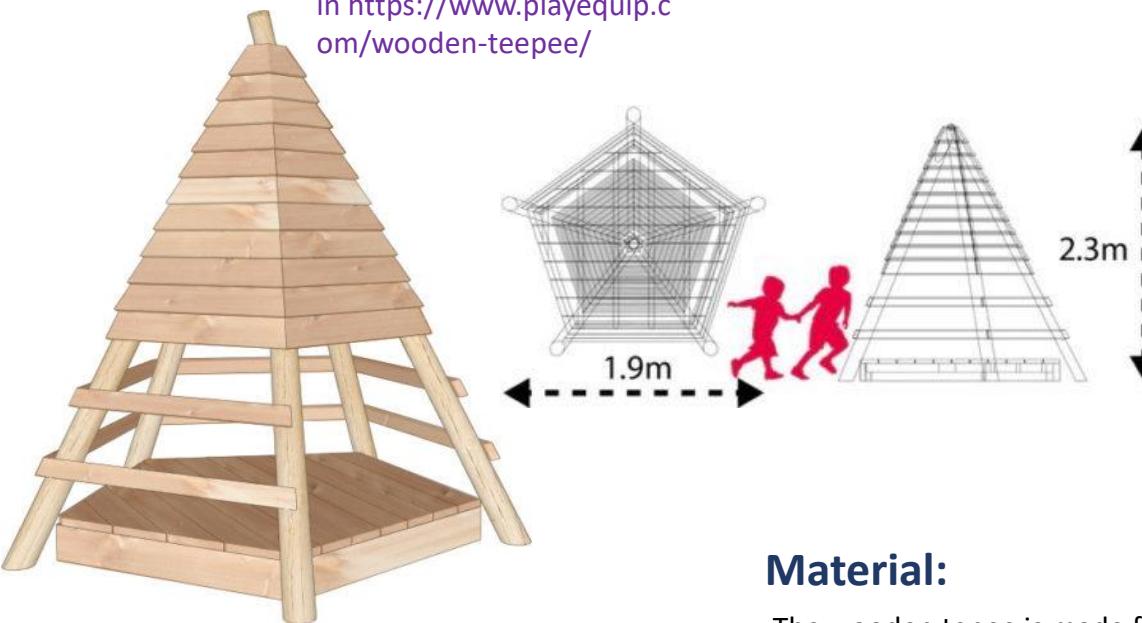
The dome contains 8 different sections each containing a different form of a climbing wall, its main objective is to improve child strength and balance. Inside the dome stellar patterns are repeated accurately within , when sunlight shines through, the star shaped holes in the dome creates glittering stellar patterns on the dome ceiling , from this children will learn to recognize different constellation and practice navigation with stars.

Overall I think this product is very cool and probably my favourite out of the recent 3, I really like how it has a learning objective to it, so that while children are having fun and enjoying their play time they are still learning something cool, if I was a kid I would definitely want to play in this. However this product is way above **price limit**, and I don't think the school would be willing to spend that much on one playground product.

# Investigate

## Investigating existing products

This product is found in <https://www.playequip.com/wooden-teepee/>



### Existing product no.4

This product is known as the **wooden tepee**

### Function and component:

The main objective of this product is to promote imaginative play in young children.. The unique design will fuel their imagination and create an imaginative world of their own, the sturdy design of the outdoor wooden playhouse ensures that they will be durable as castles, impenetrable fortresses, etc.

### Form:

This product has a unique and interesting structure. The wooden tepee is supposedly a playhouse.

### User requirement:

This product is accessible to children of any age, it doesn't have any complicated structure that can cause a young child to be prone to injury, however its sharp edges can cause injury, but they can be covered with rubber edges.

On this page I am going to conduct research on products that already exist, I will be critiquing these products and finding problems in them so that when I am up to designing a product I will know what faults to avoid, this will also help inspire me with product designs.

### Material:

The wooden tepee is made from chemical free solid larch panels and deck. The wooden tepee is made using naturally resilient timbers such as chestnut and larch meaning there is no need for chemical treatment its robust natural design gives it a 15-year guarantee.

### Scale of production:

This product is only found in one website, this product can also be customised to change to colour of it.

### Component measurement:

2.3m high and 1.9m wide at base

Cost:£3,750.00

### Sustainability:

There is no use of any chemical material as the timbers are naturally resilient, but this product is designed and made in the Uk so shipping increases carbon footprint.

### Colour:

The natural finished colour of larch and chestnut is brown; however this product is purposely kept at a plain colour so that it helps children imagine a world of their own

### DISADVANTAGES

- Colour may seem boring to children
- Might be confusing to the children as the design is unexpected

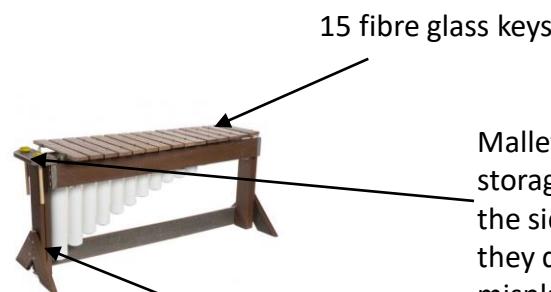
### ADVANTAGES

- Unique structure
- No chemical treatments used
- Promotes imaginative play which is a smart idea
- For children of any age

I personally think that this is such a smart idea for a product, I really like the aim of it promoting imaginative play, I also think that the structure is unique and cool, it's also toxic free as there is no chemicals used to treat the wood, the price is in-between the **price limit** so it is acceptable .

User comment: I think this product is so cool and me and my friends will have so much fun playing princesses and castles with it .

## Product 1:



Mallets have a storage space on the side so that they don't get misplaced or stolen

The durable marimba has a strong framework which is made from recycled plastic, this allows it to remain outside for extended periods of time without any damage.

The sturdy square box is made from recycled plastic

Polyethene mallets, polyethene is a very dangerous plastic to the environment, (page 2 for more information about that)

Metal bars mounted inside the wooden frame

Framework Made from post-consumer recycled plastic

The climbing grips are pressed sandstone rock which offer an authentic rock feel and never become slippery

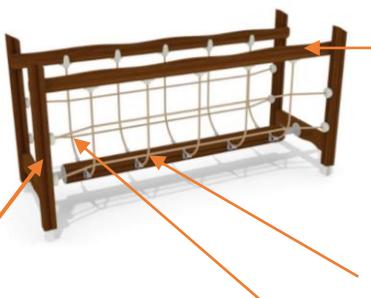
Wooden beams are made of curved glue laminated timber

Wooden surfaces are coated with outdoor/ street furniture coating ensuring that the product will last a long time without splitting, rotting or bending

The dome panels are made of high-density polyethylene (HDPE)

On this slide I will be analysing the recent 4 products more closely, and I will be annotating how they are made. This will show me how every piece is put together so that it will give me a bigger insight on how to construct my product. It will also show me how sustainable the production is.

## Product 2:



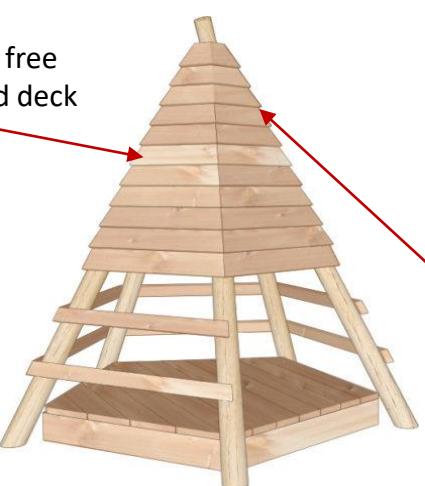
The wood is shimmer coated giving it extra protection against ultraviolet radiation from the sun

Metal parts made from low carbon steel

Glue laminated pine forms the curves of this product, glue laminated wood does not suffer from moisture and does not bend or crack over time, which is very good in the Abu Dhabi climate.

Nets are steel reinforced and cruciform joints are made from stainless steel

## Product 4:



Made from chemical free solid larch panels and deck

Made using naturally resilient timbers such as chestnut and larch

Toxic free as there is no chemicals used because the timbers are already resilient to conditions

## Product 3:



Metal parts are made from low carbon, and Lapp coat treated so they last a long time without rusting, also ensures that the metal does not get too hot or too cold in weather conditions

## Interview on a demographic that fits the category:

The person in question is 8-year-old Amanda, who goes to Brighton college. The reason I questioned, and 8-year-old is because she would be old enough to have experienced a few years at the playground so she would know what a playground is missing.

On this page I will be interviewing a user which fits the category to understand the main priorities of he product that I will be making, this will help me come up with a design that fits the overall demographic.

**Interviewer** : How often do you play in a playground?

**Amanda**: usually every break time

**Interviewer**: do you think that your playground needs new products?

**Amanda**: yes! Our school playground is very boring and almost everything is worn out or unusable

**Interviewer**: what products do you think the school needs?

**Amanda**: me and my friends like to play princesses, so a playhouse would be nice, and we also like to colour and talk, the bench is itchy and the table is disorganised.

**Interviewer**: do you think that colour in products is important

**Amanda**: yes, most of the playground equipment is brown and ugly, I would really like a product that has he colours; pink, blue, purple, red so then it's not too girly and not too boyish.

I also interviewed a boy called tom who is 8 years old and goes to Brighton as well, the reason I interviewed him is so that I had a bigger knowledge on the demographic. I kept the questions the same, so it was a balanced interview.

**Interviewer**: how often do you go to the playground

**Tom**: mostly every single playtime

**Interviewer**: do you think the playground needs more products?

**Tom**: I'm not sure, the games I play with my friends are fun, but it's starting to become boring so new products will be fun and interesting

**Interviewer**: what products do you think the school needs?

**Tom**: me and my friends like to run around and use our energy, so I think that something like a climbing wall will be fun, we also like to pretend that we are pirates, so maybe a bridge or a lumberjack.

**Interviewer**: do you think that colour affects the playground?

**Tom**: I don't really think that colour will affect weather or not people play in the playground, I would personally continue playing, is not that big of a deal. But if there were to be colours, I would like, blue, grey, purple, and orange

Conclusion from the interviews:

- The demographic mostly enjoy being interactive in the playground
- Some colour should be added to the product
- The product should fit the use of both boys and girls.

## Scientific research on colour:

Since colour is a necessary part of a playground product, doing research on what colours mostly attract children is important as that will be the colour, I include on my product

It is said that bright colours align with children's energy, young kids are drawn to it and desire play full interactions with it. Children take on the world with their eye, and bright colours help them distinguish form and categorize objects.

On this page I will be doing some extra research on colours that attract children's eye, since colour is an important part of a playground

<https://www.childsmindinnovation.com/post/35330521827/the-colour-of-childhood>

The main colours that attracts children are those on the colour wheel or the primary colours:

- Red
- Yellow
- Blue
- Green
- Orange
- Purple
- pink

Children prefer bright colours from a younger age because their eyes are not fully developed yet. They perceive these colours better than fainter shades.

## Research into the context in which the prototype will be used

How could the context of a playground affect this product?

In this section I will be looking at problems at which a playground can encounter, and more specifically, problems in which my product can encounter.

### 1- the environment

The main problem in designing a playground that is fun and challenging, is ensuring the safety of the children. Some of the materials used may scratch children, hot metals may burn them, and sharp edges may injure them, this is why when creating my product I really need to ensure that all materials used, and the finished product is safe for children use .Another safety hazard is the ground children play on, as the floor surfacing makes it easier for children to get hurt when they fall, so an important step in making a playground safer, is selecting the correct playground surfacing solution.

### 2- supervision

Children of any age are prone to get injured. An estimate of over 500,000 children are injured from a playground activity every year, playground injuries are a big problem and supervision is required at all time no matter how simple the product is. In my product I will try to not make it complex so that not much supervision is required.

### 3-Treated timbers

Another problem that has recently been occurring in playgrounds is the harmful use of treated timbers, more specifically (copper-chromium-arsenate treated timbers). Treated wood has an effect that is harmful to human beings, and so in my product I should avoid using , copper-chromium-arsenate treatment to my wood, or any toxic treatment in general.

### 4- Key risk factors

- Fall height- including measurement and places which children fall
- Guarding- capability of preventing or inhibiting other injury events
- Poor layout- there should be space between each equipment to allow walking or running freely
- Crowding of equipment
- Sitting of equipment- rusting
- Size and ability of children who use the playground

# Best weight and size

To ensure child safety, the weight of the product (if it was to be a standing product) must be much heavier than the average size of the user so that while children play with the product it does not fall on top of them/fall over.

Our users age vary between 3-12 years old. The average weight of a **3-year-old** is **11-17 kg**, and the average eight of a **12-year-old** is **26- 40 kg**, this means that the weight of my product should vary from 17 kg onwards.

If I choose to make a product that requires a handle like feature (such as a climbing wall) I need to keep in mind the size of the user's hand.

The average hand size of a **three-year-old** is **10cm from wrist to middle finger**

And the average hand size of a **12-year-old** is **18cm from thumbnail to pinkie** and **15 cm from wrist to middle finger**, so if I was to make any handle like products the size of the handle should not be less than 10 cm and no more than 20 cm so that any child can use the handle without slipping.

On this page I will be deciding the weight and size of my future product according to my user, this is very important as it links to many safety issues

Size	XS	S	M	L-XL
Average hand circumference at widest part of the hand guide from <a href="http://doradoes.co.uk">doradoes.co.uk</a>				
1 - 2 yrs				9cm
3 - 4 yrs				10cm
5 - 7 yrs				11cm
Junior	10cm	11cm	12.5cm	14-15cm
Women	15cm	16cm	17cm	19-20cm
Men	17cm	20cm	22cm	25-27cm

## Height

The average height of a 3-year-old is **35-40 inches**. And the average height of a 12-year-old is **59-60 inches**. the length of the product should be between **35-60 inches**, so it is suitable for all ages.

## Limitations:

- **The cost:** (cost has been previously considered in the client profile page)
- **Product design:** the design of the product should be suited for young children, it should contain colour and should be safe for children's use, ( no sharp edges, toxic treatments, safety of the surrounding)
- **The service:** the product could be shipped worldwide, as children often have the same things in common, all like to play in the playground, and they all like obviously bright colours, so the needs would fit many people around the world.
- **Material;** the final problem is the materials I can use, I only have materials and equipment's available in the workshop so that I can make my product, and the workshops focus is around timbers, so my product will be timber based.

In this small section I will be talking about the limitation regarding the manufacturing of the product, this is important to keep in mind while in designing the product so that I stick to the prototype and I don't go overboard with the product.

# Research into other possible material and sustainability of the timbers.

I have already mentioned the limitation concerning the materials, I now need to list the materials that are available in the workshop and their relevancy to my prototype, I have already considered the conditions in which the product is exposed to, so I need to find timbers that are strong, tough and resistant to the environmental conditions. As I list the timbers I will also consider sustainable issues associated with them.

## pine

Pine is a good all-around wood for construction, general projects and frames, however with a wide grain structure, it doesn't have a great deal of strength horizontally, but is good for a vertical use. It has a low cost and is reliable to obtain, so it is a good wood to keep in mind. However the durability will be determined over how the wood is treated, if you use 'treated' pine it will last a long time, but if you use untreated pine then it will rot in a seasons time. It can also be glue-laminated to ensure that it does not bend or crack over time. The timbers that are available in the workshops come from sustainably managed forests (FSC), despite that pine is sustainable because it grows fast enough to be forested in sustainable plantation.

## oak

Oak is reasonably strong and durable; it is commonly used in high end furniture and wine barrels. It has an attractive grain when well finished. However, it is expensive when kiln dried, oak is harder to work with than some other woods and corrodes with steel and iron. Oak is also becoming rarer to find. It mostly comes from managed forests, so it is sustainable.

## beech

Beech is a tough and hard wood, it is commonly used in (toys, cooking implements, solid and laminated furniture) and it does not crack or splinter easily, however it is expensive as it is kiln dried, and it is not very resistant to moisture, so it is not suitable for exterior use. So this is not one of my top choices of wood.

## birch

Birch is a hardwood that is commonly used to make veneers and plywood, and to surface cheaper material. Birch has a regular, even grain and is easy to work with, however it has a low resistance to rot and insect attack, so it would not be an ideal wood to use since my product is based on the outdoors.

## Polystyrene (hips)

Polystyrene hips are commonly used for vacuum forming, it is used in toys, television parts and refrigerator linings. It is lightweight, has high stiffness, high impact resistance but can be easily scratched. However it becomes brittle when exposed to UV light.

The timbers that are available in the workshop all come from sustainably managed forests, so their sustainability is not a concern.

The timbers that I choose must be resistant to water and durable to outdoor weather conditions.

In this section I will be listing timbers that are found in the workshop and their relevancy to my product, this will help me decide what material to use and why.



## cedar

Cedar is a natural softwood, which is commonly used for outdoor furniture, fences, sheds and boats. The main advantage is that cedar has natural oils which make it resistant to water and fungal growth which is very good for my product since it is based on outdoor. However cedar is more expensive than pine and is not as strong.

## Manufactured timbers

Manufactured boards use timber to manufacture a board that has different properties to plain timber. Manufacture boards are made from wood scraps and remainders, so they are sustainable and a good way of using up unwanted wood.



## plywood

Plywood is commonly used in buildings, and furniture panels that need some strength. Plywood is a tree trunk sliced into thin layers called veneer, which is then glued together with grain lines going in alternate direction. Plywood is flat and structurally strong, its surface looks exactly like wood and it is resistant to warping, cracking and twisting. However it is quite expensive, the edges can look rather rough and is susceptible to water damage if wrong grade is used.



## Medium density fibres (MDF)

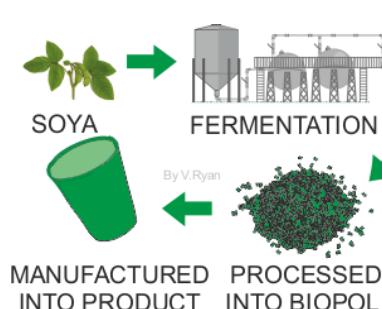
MDF is commonly used in cheap flat pack furniture, wall panels, display cabinets and storage units. MDF is made from wood dust and fibres mixed with a glue and pressed into flat sheets under extreme pressure. MDF is good because it is made from wood waste, so it is sustainable, it has a smooth ungrained surface which is good for painting or staining and it is easy to machine. However MDF alone does not look good so coating is necessary, it is weak compared to real wood, and tools blunt quickly because of the glue.

## Other materials



## Mild steel

Mild steel is an alloy, it has great elasticity and malleability. It can be easily machined and its hardness can increase by adding carbon. Mild steel can be used in connecting the timbers together in different parts of the product. However it rusts very fast, so its appearance won't be pleasant for long.



## Biopol

Biopol is a fibre, granules sheet. It is commonly used in disposable cups, razors, cutlery and other packaging products, surgical stitches and pins. It is lightweight, good electrical conductor, insulator and degrades in soil and can be disposed of in landfill sites. So this is a good alternative to plastic however it is expensive to produce and has low resistance impact.

## Where will this product be sold?

This product will be designed in the UAE and can be shipped worldwide, since the children's demographic all basically like the same things it will be easier to fit the needs of people and playgrounds around the world.

In this section I will be indicating where my product will be sold and any sustainable issues that are associated with the product while shipping.

## How will it be shipped?

The product will be shipped via UPS courier, depending on where the product is shipped the price will range,

If the product is shipped within the UAE, then shipping price will be (£40.00),

If the product is shipped to Europe regions, then the shipping price will be (£81.98),

If the product is shipped to the USA then shipping price will be (£94.65),

If the product is shipped to other countries, then the shipping price will be (£90.03).

## Sustainability issues concerning the packaging and shipping.

The UAE already has the highest ecological footprint in the world, so with my product I will try not to increase. The main way of Transportaion will be by a vehicle, 31% of carbon footprint is produced by transportation, I cannot cut off transportation as it is the main way the product will get around the world, so instead of using a car per product, I will be sending a various amount of the product at the same time in the same transportation to UPS, where there they will send them off to their users.

The product will be placed in a cardboard box as it is cheap, and easy to fit the dimension of the product, my product will have to be a knock down fitting, so it is easier for the user to place the product together, and so it doesn't get damaged while being transported. The product will also need to be bubble wrapped to ensure there is no breakage, however since I am trying to make my product as sustainable as possible bubble wrap is an unnecessary use of plastic and there can be alternatives,

Researchers in the Agricultural research service are looking into using dairy based films as an alternative for petroleum-based packaging, instead of being made of synthetic polystyrene, these dairy based films will be composed of proteins such as whey and casein, which are found in milk, these films will be biodegradable and offer better oxygen barriers than synthetic. This is a much better alternative than polystyrene based packaging as polystyrene is an ecologically damaging plastic that cannot easily be decomposed or recycled. The use of these will resist the product from scratching while transport.



## Product specification

After all the recent research , I can conclude that I will be working on a product that can be purchased online and comes prepacked with items clients need. My product will either be an organised bench which children can sit and talk on and socialise, or an interactive rotating 4-sided box which will contain interactive games such as (climbing wall, basketball hoop and ball, x and o's and a side of cabinets filled with playground basics)which ever idea I go with, the product must be child friendly, it should be rounded, so there are no injuries regarding the sharpness of the product, it should be organised and comfortable, and should contain colour, the product should also be made of durable timbers that can handle outdoor weather conditions. The client who will be between the age of 2-12 will want a product that helps them interact with their friends and make break time more fun. The user needs a product that is organised and sustainable. The aim of this product is to make break time/ recess a more memorable and fun time.

The prototype will be assessed based on these specifications; each specification is awarded a certain value depending on its importance. **Must**(+3), **should** (+2), and **could** (+1). By adding up the points, we can see if the prototype is successful or not.

On this page I will be summarising the research I did on the previous pages, each summary will be given a number of points so that we can see if the prototype is successful.

My final product will solve the problem of interaction and organization in a playground. In order to solve this problem, my product will be made for the use of 2 or more children, so it will not be possible for children to play with the product alone, they will need a friend, so this will solve the problem of children being alone during playtime. To solve the problem of organization, the product pieces will be attached to the product so that it will not be possible for the product to become loose and unorganized and it will extend the lifetime of the product.

Specification area	Specification point	Slide number	explanation
<b>Form (A)</b> Total points(9)	A1- the product <b>must</b> include the colours(red, yellow, blue orange, green ,pink and purple) A2- the size of the product <b>could</b> be 899-1524mm (length) and 965.2mm (wide) A3- the product <b>must</b> be colourful and organized A4- the product <b>should</b> be fun and interactive	A1- 14 A2- 15 A3- 14,5 A4- 14,15,3	A1-as demonstrated by my research, these are the colours that attract children's eyes. I can test this by asking the children what colour in my product they like the most. A2-these are the measurements of heights is the average height of my demographics age, and the width is enough to allow several amounts children to use my product at the same time. A3- according to the interview in the start of my research that is what the playground really lacked A4- according to my interview children enjoy being interactive during break time.
<b>Function (B)</b> Total points(5)	B1- the product <b>must</b> be made of durable timbers that can handle outdoor weather conditions and should be immune to insect and rot. B2- the product <b>should</b> contain some sort of structure that allows the product to be organised	A1- 16,10 A2- 13,8, 5	B1- my product is going to be situated outdoors since it is made for a playground, and so it should be able to handle any type of weather condition and should be able to fight off rot and insect attack. B2- this will meet the needs of the user and will make playtime pass faster and at ease.
<b>User requirement(C)</b> Total points (7)	C1- the product <b>could</b> be knock down fitting C2- the product <b>should</b> be no less than 10 k and no more than 30 kg. C3- the product <b>should</b> not be too complex C4- the product <b>should</b> be rounded and safe. C5- the product <b>must</b> be playable by both girls and boys	A1- 17 A2- 15 A3- 14 A4- 13,14	C1- this will make Transportaion easier, so that the buyer could place everything together, and so there is no breakage during shipping, also doesn't require Maintenace when it arrives. C2- his means that the product will be stable and would fall over no matter the weight of the user. C3- this avoids injury and wouldn't require much supervision C4- also avoids injuries to do with sharpness.

Specification area	Specification point	Slide number	Explanation
Performance requirement (D) Total points (9)	D1- the product <b>must</b> be stable and not fall over D2- the product <b>must</b> be heavy D3- the product <b>must</b> be resistant to water and scratches. D4- product size and weight <b>must</b> vary within the previous weight research	D1- 15 D2- 15 D3- 16,17 D4- 17	D1,d2- so that whatever the weight of the user, it does not fall on top of them and it is grounded safely , and that it is stable. D3- the product may be in a playground with grass, so if the grass is watered and water goes on the product it does not rot, and it should not scratch while being transported. D4 this ensures that many children of different sizes can use the product without limitation, I can test this by measuring a child from each year and seeing if they fit my product and its user requirement.
Material and component requirement(E) Total points (13)	E1- materials <b>must</b> be environmentally friendly E2- materials <b>should</b> be available in the workshop E3- the product <b>should</b> contain various materials E4- the product <b>must</b> be made of mostly wood E5- other materials like polystyrene and steel <b>could</b> be used but <b>should</b> be used in small quantities	D1- 16 D2- 16 D3- 16 D4- 16 D5- 16	D1- my main objective is to decrease carbon footprint through my product. The less waste I make, the less the cost of the production will be. I can test how much waste is made by calculating how much of the material I used D2- since I am working in a workshop, I can only use material from there D3- wood will not be able to succeed in every function, so other material is necessary D5- to lessen the use of crude oil and energy can test this by measuring how much of the material is used.
Scale of production and cost(F) Total points(6)	F1- production <b>should</b> be no more than £3000 F2- I <b>should</b> not spend more than 50 hours making this product F3- manufacturing the product and buying the material <b>should</b> not cost me more than £500	F1- 5	F1- through my research and interviews have found that the buyer is not willing to pay more than £3000 for a playground product. So I should make use of this money and in order to forecast a profit out of this I should not spend more than 50 hours making the product for me to gain what I am paying for the production, manufacturing and buying material should also be kept at the lowest price possible in order to make a profit, however material bought should still be in great quality.
Sustainability (G) Total points (6)	G1- during production, a little waste possible <b>should</b> be produced. Material should be accurately calculated G2- materials used during production <b>should</b> be recyclable as well as the packaging. G3- packaging <b>should</b> not use polystyrene	G2- 16 G3- 17	G1- reducing the waste, reduces the price as less material is used G2- material should have a good LCA (life cycle assessment) G3- polystyrene is a very polluting plastic which does not biodegrade, I should limit the use of it so I can limit the amount that gets to the environment.

Assessment criteria:

As previously considered, one way of assessing the criteria is through the specification score. This is worth 58 points. However I will also interview around 10-15 people and I will ask them to rate the product. Aesthetic appeal will equal 10 points – and manoeuvrability will equal 10 points as well. The mean will then be calculated, so, the final rating will be out of 71.

Total points: 58

# Design 1:

## Description of the product:

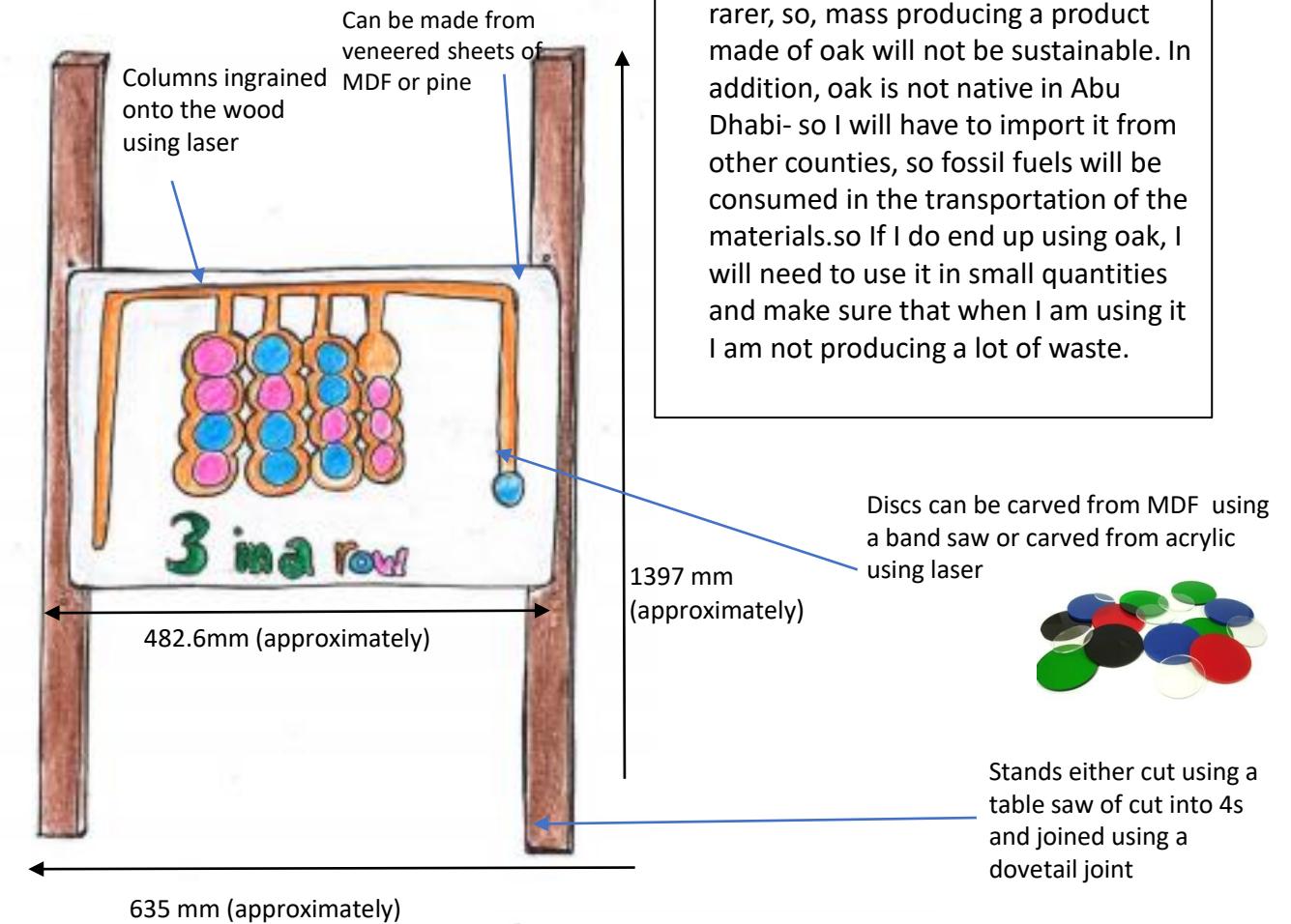
This product is an interactive 3 in a row game, there are 2 different colored discs both which will be at either side of the product, the children will aim to get 3 of the same colored discs in a row before their friend does, the main aim of this product is to help interaction, and because there are two different colored discs, it is necessary that two children play at the same time, helping with instructiveness and fun, and the discs will be unable to be removed from the board so the life span of the product will increase as the discs will not be lost.

## Aesthetic:

- This product is a simple and complex design, it will be a complicated design to make but very easy and straight forward for children to use.
- It will be very colorful, (to attract children) colors will be those discussed in the "scientific research" slide.
- Its height will be suitable for the reach of children of various ages , so the height will vary from (899-1524mm)

## Material:

- The stand can be made out of **oak** because oak is strong and durable and has an attractive finish, it is also commonly used for boats meaning that it is water and moisture resistant so it is suitable for exterior use and wont splinter and crack easily, however it is quite expensive to buy oak and it is harder to work with than some other woods
- **Pine** can be an alternative for oak, it is very durable to weather conditions and easy to work with, it grows quickly so it is a better alternative for sustainable sake, and reasonably strong, so it will stand up right and hold the weight of the product without any hassle.
- **Cedar** can also be an option as natural oils make it resistant to water and fungal groth which is perfect for exterior use.
- The discs can be made from **acrylic** or cut out circular pieces of wood such as MDF.
- For the main board I can either use **MDF** or thin sheets of balsa and veneer it



## Component:

This design is very interesting, in order for the children to connect three colored disks in a row they will need to move the disks, so since my product is focused around organization, I have produced a solution to help children play the game continuously without losing the disks. A smaller size disk will be inserted inside the ingrained columns, the disks could then be magnetically glued to the smaller disks , this will allow free movement of the disks and help maintain the lifespan of the product because it will resolve the issue of children losing the disks.

On this page I will be producing a design idea in detail and analysing it with a range of issues when producing the product, this will help me brainstorm ideas for my final product

## Budget:

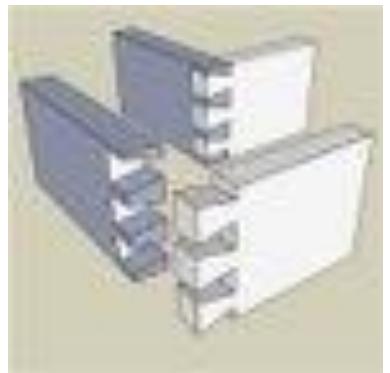
Budget has already been discussed in the previous slides (slide 5 and 6)

## Processes and techniques:

- I will need to cut either 2 , 1397 mm oak planks using a **table saw** to make the stand or 4 planks and use a **dovetail joint** to connect them together(this will ensure stability), I can also use a wood lathe to sharply make the stands.
- For the main board I can **veneer thin sheets of MDF** to make it stronger and more durable this will make the board resistant to wrapping and have a longer life span. And for this I will need to use a gentleman saw. The board could be **nailed** onto the stands.
- The columns in which the discs will be rolled through can be **lasered** and ingrained into the wood this will improve accuracy of the thickness of the columns..
- The discs can be made of thin mm of **acrylic** to give the product a further aesthetic, or they can be made of thin carved MDF. They can be carved accurately using a band saw or lasered.
- To connect the discs into the columns they will be **magnetically glued** to smaller discs that can fit inside the ingrained wood, this will make the product easier to use.
- In the end, there will be 16 discs each will be either of the two colors chosen (demographic will be interviewed and will choose) the columns and the board will also be painted to give the product some pop of color to attract children, and finally after everything is done, it will be clear coated to avoid chipping of the paint.



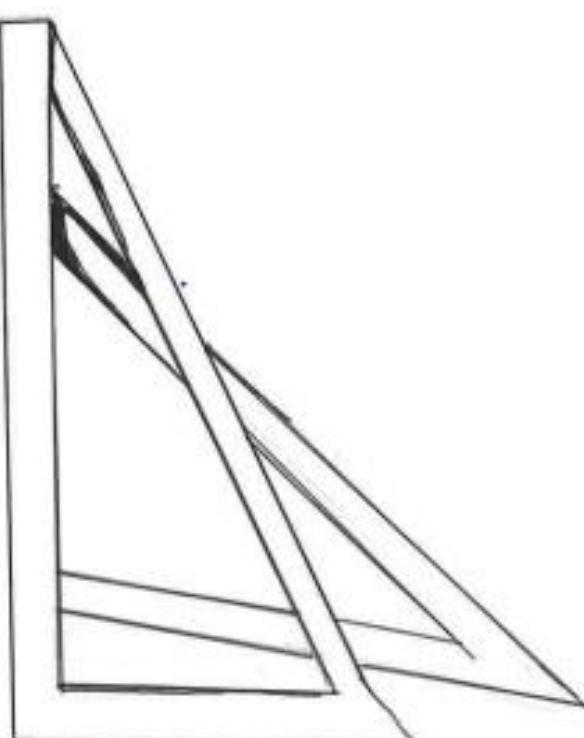
(Initial idea continued next page)



Dovetail joint which will be used for connecting the planks of the.



This is an example of lasered wood, the final product has a 'dent in the wood, this will help with my idea of magnetically connected discs.



back view on how the stand will stand upright

Material bank:



This is what veneered MDF looks like, it has a nice finish and can be even painted on top of. This can be used for the main board.



Oak (sands)



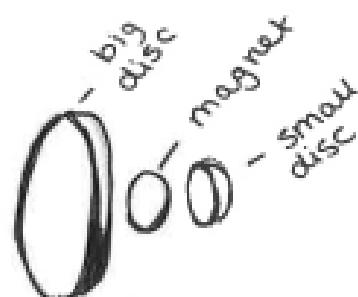
Pine(alternative for oak)



Acrylic(discs)



Magnet discs (for the 3 in a row discs)



## Design 2:

### Description of design:

This product is an interactive bench, the main aim of this product is to add something extra to children day to day playground product. This bench will have more color added to it, to attract them more to the product, there will be board games ingrained onto the bench table, each board game requires 2 or more children to play at the same time in order for the game to actually be played, this helps with the 'interactions' problem in a playground, and because more children are playing together it will solve the problem of 'fun' during break time. Each game will have its own drawer, so the pieces that link to the game will be placed in an organized matter into the drawers, this helps resolve the problem of 'organization' and gives the board games a longer life span as the pieces allocated to it will be less likely to be lost.

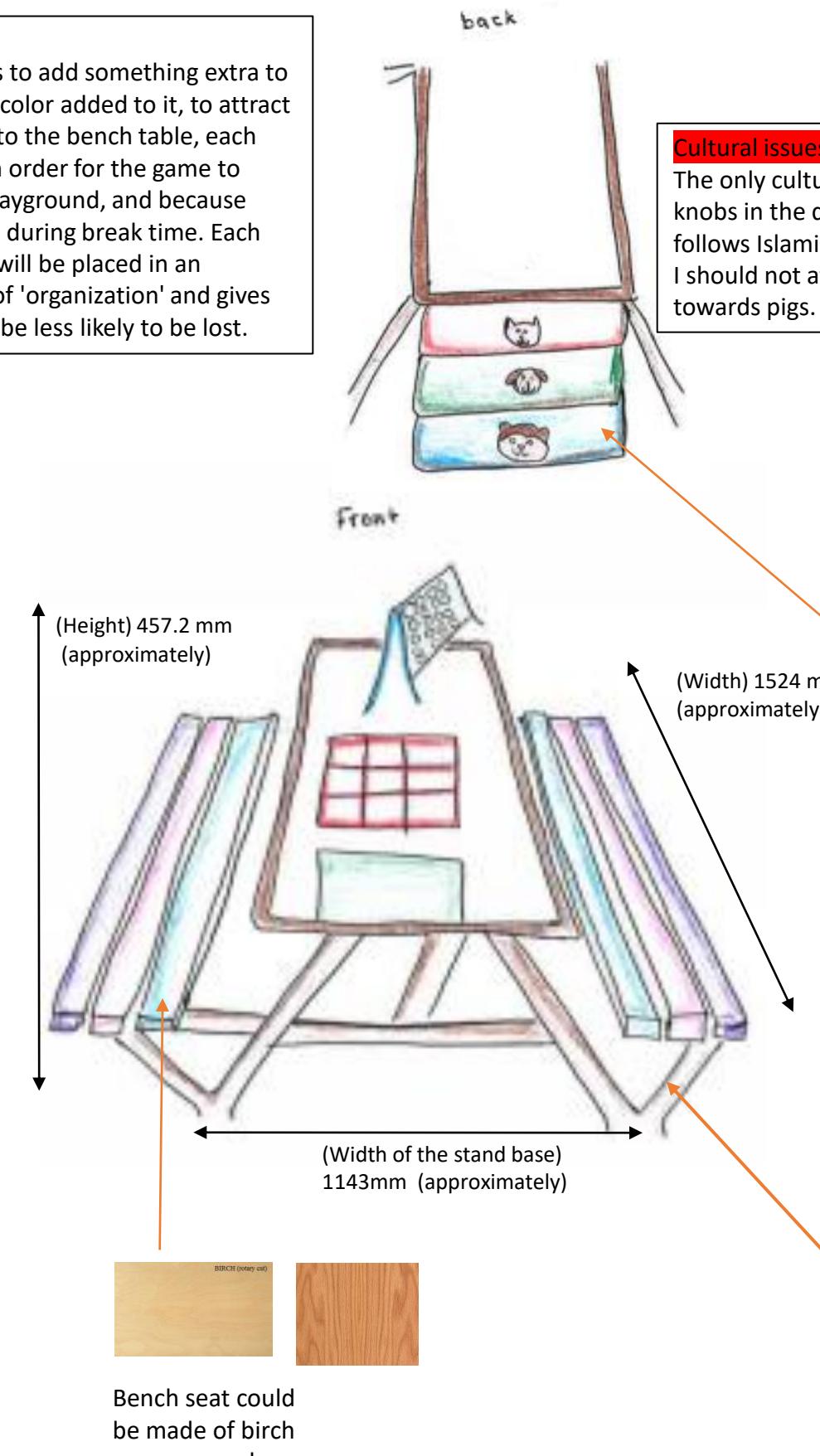
On this page I will be producing a design idea in detail and analysing it with a range of issues when producing the product, this will help me brainstorm ideas for my final product

### Aesthetic:

- This product will be simple for children to use, to avoid over complexity of the product which may unattract children to the product.
- It will contain many colors, (of those mentioned in the 'scientific research page') the bench seats will each have a different color, but will be symmetrical on each side, each board game will have a color allocated to it, in which the drawer will be the exact same color.
- The product will be wide enough to fit at least 3 children on each side , so it should be more than 1524 mm wide and 457.2 mm in height.
- Bench will need to be heavy so that it won't fall over when being over, and to ensure stability.

### Material:

- For the base of the bench (the stands) can be made from **larch** as larch is a tough and durable timber and is resistant to water, and it can be used outside untreated which is perfect as my product is based on exterior use, and because it is the stand, it means it will be in contact with the ground more than other parts of the bench, and s it might be in contact with water or insects, so it is vital that the timber is durable to this condition.
- The bench in which the children will be sitting can be made from **birch**, because birch has a even and easy grain to work with , but it has a low resistance to rot and insect attack, so to avoid this, a layer of veneer can be added to the surface of the wood to strengthen it.
- Or an alternative for birch can be **oak**, as oak is strong and durable, and has an attractive grain when well finished and is durable to exterior. However oak is expensive and is usually harder to work with than some other woods.
- The drawers can be made of **larch or beech**.



### Cultural issues:

The only cultural issues concerned with this product is the animal knobs in the drawer. The UAE is a culturally sensitive culture, that follows Islamic beliefs, so if I do include animals as my drawer knob, I should not at all include a pig as the Islamic religion is sensitive towards pigs.

### Component:

The drawers will be needed to be opened somehow, so I could use something more childlike, so I could use animal knobs to give the product a nicer look and attract children more.

Drawers can be made from laminated larch or beech



I got this idea from a picture I saw on Pinterest

Stand could be made of larch



(Initial idea continued next page)

### Budget:

Budget has already been discussed in the previous slides (slide 5 and 6)

### Processes and Techniques:

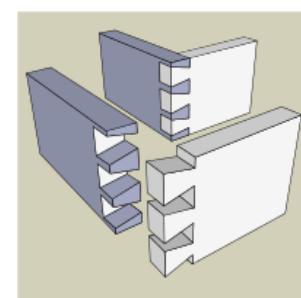
- To make the bench stands, I will need cut multiple planks of larch and use a **dovetail joint** to join them together, they could then be sanded so that the dovetail does not show that much. The stands will be needed to be made from many layers of wood to form a thick base, as the stand will hold all the weight of the bench it will need to be securely strong, to make sure that the bench is stable and won't fall over when being used.
- The bench seats, will be made in a similar way as the stand, various pieces of wood will be cut and joined together via a **dovetail joint**, the 'seat' will need to be thick so that it can hold the weight of children of any size. to be joined into the stand there will be a base from the stand and they can be joined via a **dowel joint**.
- The table can be made of layers of MDF and can then be **veneered** to add strength to the table.
- The board games can be lasered onto the table to avoid any problems of the loss of games . They can en be laminated so they can handle conditions of the outside and can last longer for children use.
- For the whole base of the drawer is will be made from 381 mm width and length of larch and can be joined together via **dovetail joint**. And they can be laminated to give them extra durability to the exterior conditions and what it will be going through due to the children.
- The inside of the drawers contain curved parts so I can use a band saw to cut pieces of flexibly needed and then use PVA wood glue to add a layer of veneer onto the wood, I will then create a **foam mold piece** using the flexy ply to form the curve, for this will place my flexi ply on the mold and place it inside the **vacuum molder**. After the curve is formed, I can use veneered MDF to make bases of the drawer and I can join the pieces together using a **biscuit joint**.
- To enable the drawers to open and close I could use **router** to ingrain a dent into the base, this will secure the position of the drawer and enable it to roll open and close easily.

### Sustainable issues:

The bench 'seat' might possibly be made out of oak, so If I use oak in this product there will be some sustainable issues, oak is a hardwood meaning it takes a long time to grow back and it is becoming rarer, so, mass producing a product made of oak will not be sustainable. In addition, oak is not native in Abu Dhabi- so I will have to import it from other counties, so fossil fuels will be consumed in the transportation of the materials.so If I do end up using oak, I will need to use it in small quantities and make sure that when I am using it I am not producing a lot of waste.

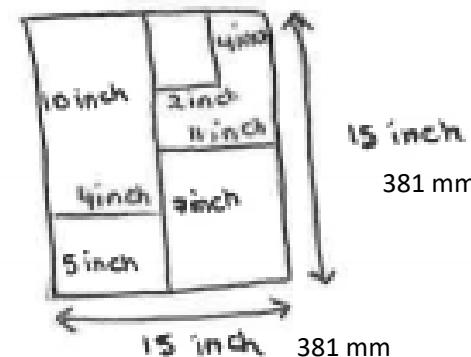


Router (for drawers)

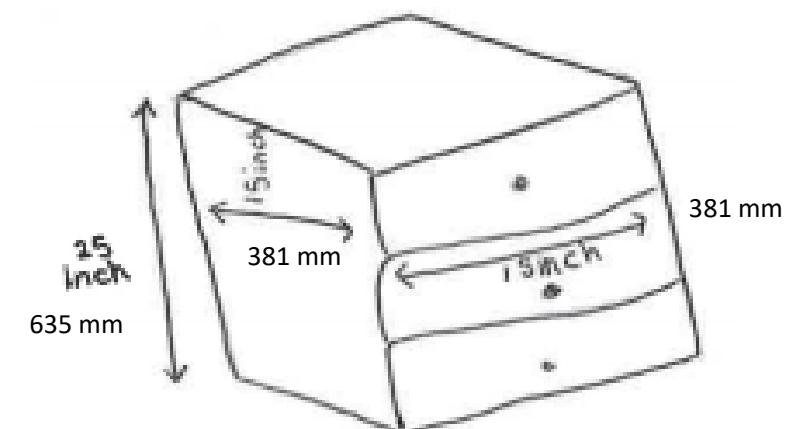


Dovetail joint which can be used for seat, and stands

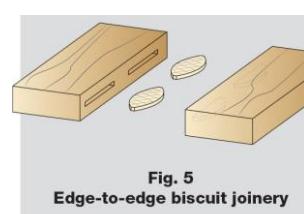
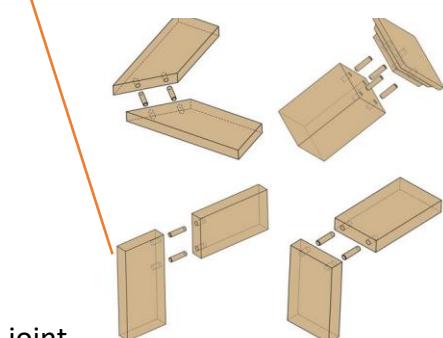
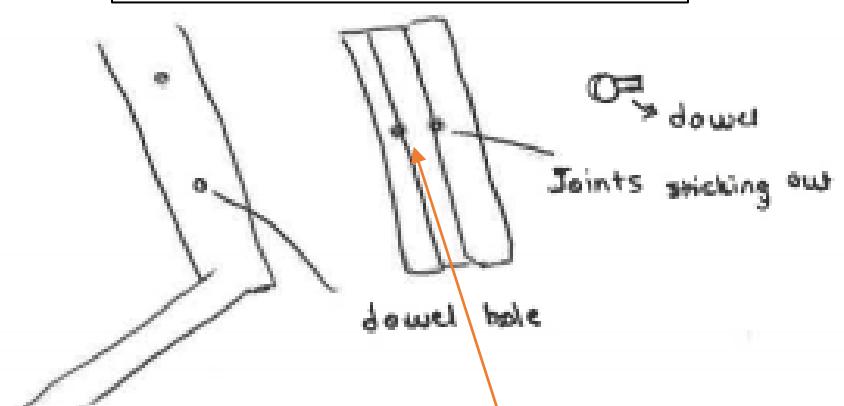
### Drawer organisation



### base of drawer



### How the seat will be connected to the base stand

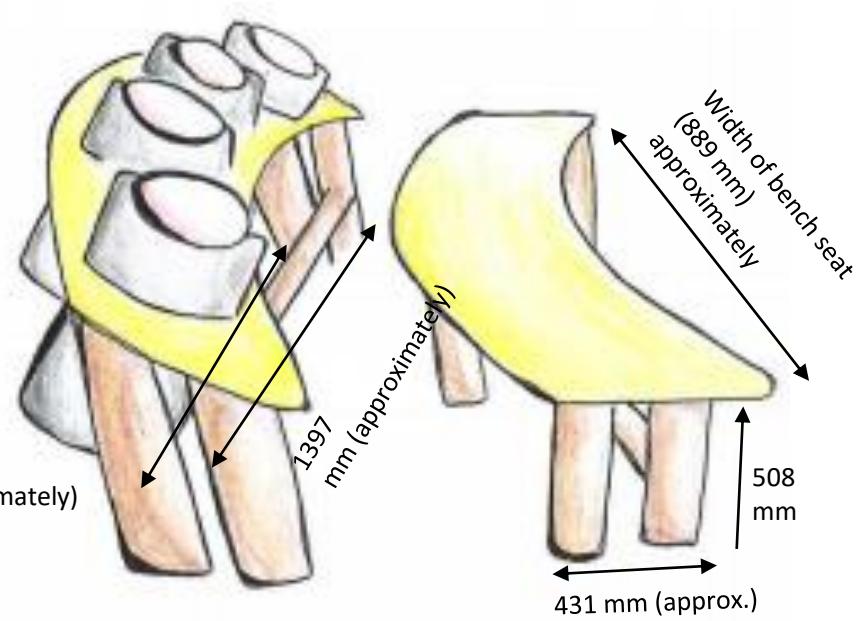


Biscuit joint can be used to connect the curved parts of the drawer together.

# Design 3:

## Design description:

Here I have produced 2 of a similar kind of product that can be joined to form one product. This product has a kind of a 'seesaw' effect, where it requires two or more people to be able to function the product properly, the product contains a nursery rhyme that children are required to work together to compose it, this solves the 'interactive problem'. The main aim of this product is to help children have fun through a music, in which they can find their love for music, by joining both products together to form one, it will solve many problems in a playground, and it will be a new kind of product for the playground which will excite children.



## Aesthetic:

- This product will be very colorful as mentioned before.
- Each musical 'tube' will be of different size and thickness to produce different sounds
- The final product will have a 'seesaw' bench (balanced) where at different heights there are different sized tubes, where the children will need to work together to use.

## Budget:

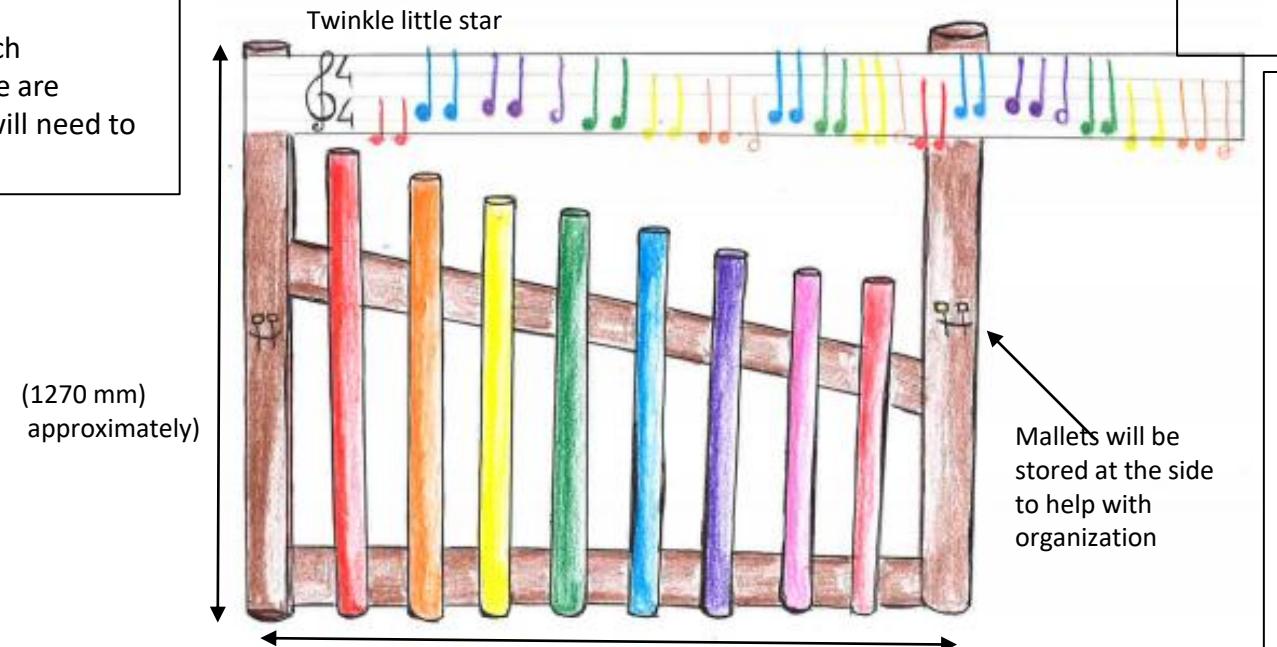
Budget has already been discussed in previous slides (slide 5 and 6)

## Sustainability issues:

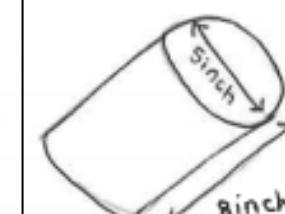
- There is a possibility of using oak, however oak is not one of the best choices due to its sustainability background, it is becoming rare, and because it's a hardwood it takes a very long time to grow, so it is not the best idea to use oak, to minimize my carbon footprint, however if I do end up using oak I should keep it to a very minimum and lessen the waste my product makes.

## Component:

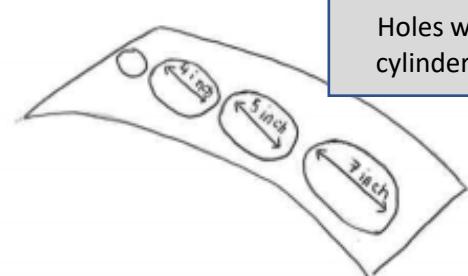
To produce the sound through the cylinders, acrylic will be inserted inside the cylinder, so the size of the acrylic needs to be equivalent to the diameter of the cylinder, so that it can be inserted inside, then it can be stuck to the cylinder by using PVA glue.



inside the tubes



Each cylinder will be of a different size, this will help compose different sounds



Laminated and curved MDF for the musical cylinders



Larch for the bench stand



Laminated birch for the bench seat

On this page I will be producing a design idea in detail and analysing it with a range of issues when producing the product, this will help me brainstorm ideas for my final product

## Material:

- The bench stand can be made from **larch** as larch is a tough and durable wood and is resistant to water, and it can also be used for exterior uses which is perfect for my product as it is based on the outside, and because the stand will be the closest piece to the ground it is vital that it is resistant to insect and water, as it will be put through a lot outside.
- The musical cylinders can be made from **laminated** and **curved MDF or birch** and can have different sizes of circular acrylic discs on the inside of the product, this will help form the different sounds of the musical composition.
- The bench seat and table where the cylinders will be inserted can be made from **laminated birch**, as birch has an even and easy grain to work with making it easier to form the curved shape.
- Acrylic can be inserted into the tubes to help form the sound.

## Techniques and processes:

- In order to form the musical cylinders, I need to form a **curved mold** of the shape I am aiming to form, and from there I will place the thin-thick planks of MDF or oak on the mold and place it in a vacuum and carry out the process to form the different size cylinders.
- To form the curved bench I could join different planks of birch together using the **biscuit joint**, and I could then use a router to form the curve of both the table and seat.
- The holes where the cylinders will be placed could be drawn using a **protractor** and cut sharply using a **band saw**, to sharpen the circle, I can use the band saw to get rid of any excess wood.
- The stands of the bench can be made by accurately cutting out thick 431.8 to 508 mm-thick larch planks and joining them to the seat using **dowel joint** to ensure secureness and stability of the bench. The planks must be heavy and stable to ensure stability to the product.

# Ways in improving the product.

## Form:

For each product that does not meet my specification point I will outline how I will improve the product to meet my specification.

- **Specification point:**
- the product **must** include the colours(red, yellow, blue orange, green and pink purple)
- the size of the product **could** be 899-1524mm (length) and 965.2mm (wide)
- the product **must** be colourful and organized the product **should** be fun and interactive
- **Points met:**

- The product includes the colours pink, blue, orange and green
- The product size varies within the measurements of 899-1524mm length.
- The product is colourful and will be interactive.

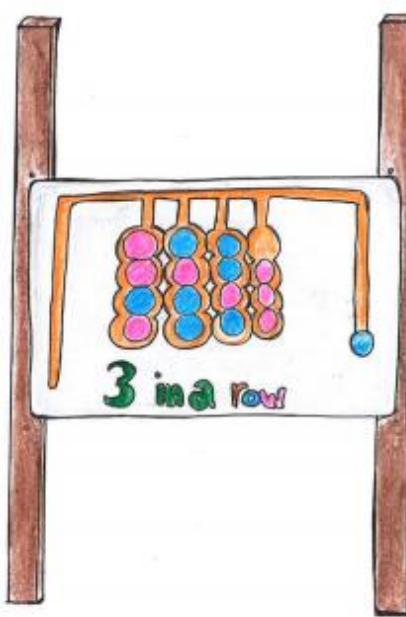
### How I can improve this product according to the specification:

- The width of the product suggested through my product specification is 965.2mm wide but the width that I put for this product was 558.8mm so to meet the specification point I can increase the width of my product , this can also mean that more columns can be inserted so rather than '3 in a row' it can be for example '5 in a row'.
- To make the product more aesthetic instead of the brown stands I could colour them a different colour preferably one of the ones suggested in the 'scientific research page'

## Function:

### Specification point:

- the product **must** be made of durable timbers that can handle outdoor weather conditions and should be immune to insect and rot.
- the product **should** contain some sort of structure that allows the product to be organised
- **Points met:**
- The product will be made of oak, pine, cedar, acrylic and MDF.
- The product is organized because the discs are inserted into the laser cut columns via magnets, so they will not be able to be removed from the product itself, so it solves the organization problem because the discs will not have the possibility of getting lost. There will be two different colored discs both will be placed at either side of the board and then can magnetically move to form a 3 in a row.
- **How I can improve this product according to the specification:**
- The product will mostly be made of oak(oak takes 100 years to grow and is usually very expensive) , so to decrease carbon footprint I could either decrease the quantity of oak used or use a more suitable wood that would effect carbon footprint as much.



## User requirement:

### Specification point:

- the product **should** not be too complex
- the product **should** be rounded and safe.
- **Points met:**
- The product is round, and it does not contain any sharp edges.
- The product will not be too complex for children to use

## Material and component requirement:

- **Specification point:**
- materials **must** be environmentally friendly
- materials **should** be available in the workshop
- the product **should** contain various materials
- the product **must** be made of mostly wood
- other materials like polystyrene and steel **could** be used but **should** be used in small quantities
- **Points met:**

- Most of the materials used are environmentally friendly
- Materials justified for use are all available in the workshop
- Small quantities of acrylic will be used
- **How I can improve this product according to the specification:**
- To improve the product to an extent I should try to keep my woods as environmentally friendly as possible.

## Performance requirement:

### Specification points:

- the product **must** be stable and not fall over
- the product **must** be heavy
- the product **must** be resistant to water and scratches.
- product size and weight **must** vary within the previous weight research
- **Points met:**

- The product is stable because there is a stand that will be part of the product in the back and this ensures that the product will not move no matter the case (kids leaning on it, or the wind blowing it away)
- The woods that will be used their properties include water resistance and rot.
- **How I can improve this product according to the specification:**
- To meet the performance requirement to an extent I need to make the product heavy enough to be stable on the ground but not too heavy where it will not be able to be moved around the playground to change its location.

On this page I will analyze and evaluate how my design meets the design brief and products specification, I will also justify how I can improve the product to meet the specification points. This will help me develop a final idea for my product and will help me keep in mind how my final product should meet the specification.

## Design 1:

## Scale of production and Cost:

### Specification point:

- production **should** be no more than £3000
- I **should** not spend more than 50 hours making this product
- manufacturing the product and buying the material **should** not cost me more than £500

### How I can improve this product according to the specification:

- In order to decrease the amount the product will be I will need to cut down on the timbers used, for example oak is one of the more expensive woods, so In order to decrease the price of the product I can cut out on the amount of oak used,
- In order to decrease the amount of time I need to spend on the product I need to decrease the price of the product and to do that I need to use cheaper materials, for example if I want to decrease the price of £3000 I need to use less materials like oak and acrylic.

## What I personally like about this product:

- I really like how organized this product is.
- And I also really like the main function of the product and how it requires children to think before taking action, this will bring out the competitive side of children making playtime more interactive and fun.

## What I can improve in this product

- The stand of this product is quite dangerous from the front because if a gust of wind hits the back of the stand it will fall over so I need to design a stand that is suitable for both sides of the product and ensures full safety.
- I can make the product suitable for more than one use, so I can make this product double sided so there's a different function on both sides, and this will also decrease the amount of products needed to be bought for a playground.

## Does it follow the design brief?

- **Design brief**
- My final product will solve the problem of interaction and organization in a playground. In order to solve this problem, my product will be made for the use of 2 or more children, so it will not be possible for children to play with the product alone, they will need a friend, so this will solve the problem of children being alone during playtime. To solve the problem of organization, the product pieces will be attached to the product so that it will not be possible for the product to become unorganized and it will extend the lifetime of the product.
- **Does it meet the design brief?**
- Yes, this product idea does meet the design brief; it solves the problem of interaction because to connect three discs in a row it requires a friend to play as the opponent, so then the children can challenge each other to see how connects three in a row first. It solves the problem of organization in a playground because the discs will be magnetically connected to the board so they cannot be detached and lessens the possibility for them to be lost, and expands the life time of the product.

# Ways in improving the product:

For each product that does not meet my specification point I will outline how I will improve the product to meet my specification.

## Form:

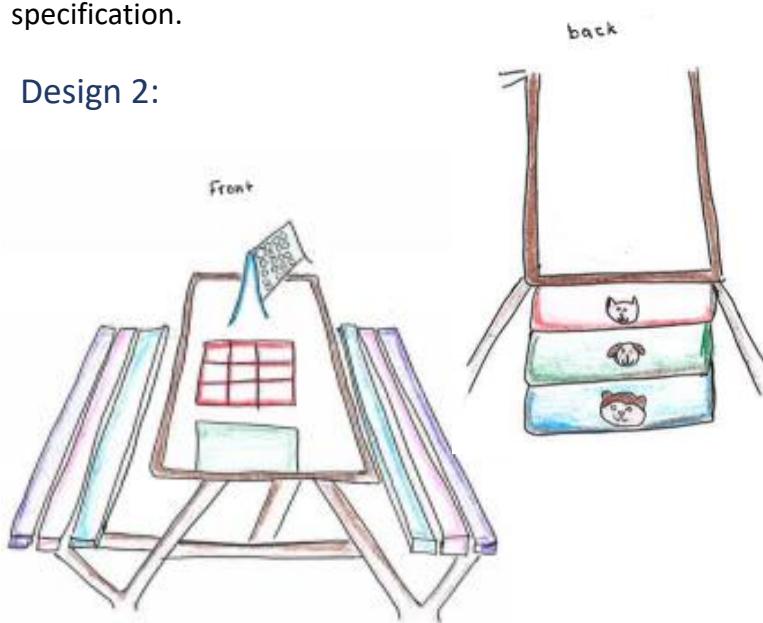
### • Specification points

- the product **must** include the colours(red, yellow, blue orange, green ,pink and purple)
- the size of the product **could** be 899-1524mm (length) and 965.2mm (wide)
- the product **must** be colourful and organized
- the product **should** be fun and interactive

### • Points met:

- The product includes the colours (pink, blue, red and orange)
- The product is 60 inches in length and 45 inches in width
- The product is organised (hence the drawers)
- The product is interactive as each board game requires 2 or more children to play with it
- How "fun" the product is will be judged by the children

## Design 2:



## User requirement:

### • Specification points:

- the product **could** be knock down fitting
- the product **should** be no less than 10 k and no more than 30 kg.
- the product **should** not be too complex
- the product **should** be rounded and safe.

### • Points met:

- The product will be more than 10-30kg because the quantity of wood will be a lot and the general weight of a wood plank varies from 2-4 kg, so the overall weight will pass the required weight.
- The product will be very straight forward for children and it will be easy for them to understand how to use the product.
- All the edges of the product will be rounded and if necessary, a corner bumper can be used to prevent any injuries from potential sharp edges.

### • How I can improve the product according to the specification:

- To make the product easier for the buyer to assemble ic can make the product knock down fitting, where there are main parts already constructed and then can be put together via temporary joints that can be screwed to the already constructed parts. By making the product knock down fitting, it makes the product more suitable for the buyer, as it would be less hassle for them as there will not be the need of too much maintenance, which again will increase the price the buyer needs to pay for the product.

## Function:

### • Specification points:

- the product **must** be made of durable timbers that can handle outdoor weather conditions and should be immune to insect and rot.
- the product **should** contain some sort of structure that allows the product to be organised

### • Points met:

- The product will be made of birch, oak, larch and beech which are mostly qualified as durable timbers.
- Beech has a high abrasion resistance which is good as it will come in contact with many children and might try to scratch. Oak is strong, heavy and durable and is resistant to insect attack due to its dense constitution and long-living nature. This is a suitable material for the product as the product will be placed outside so it will encounter with a lot of insects. Birch has good strength properties and has good elasticity and toughness but not practically hard,. Larch is a heavy and hard wood it is stable and elastic, it is not subject to considerable shrinkage and is strong and sturdy
- The product contains drawers in the back f the bench, this allows the product to be organised as it eliminates any changes of messiness on the bench. Each game has a drawer dedicated to it so things used for the games such as (coloured discs, chalk , markers, etc.)can be placed inside the product dedicated to the game.

### • How I can improve the product according to the specification:

- In my specification it outlines that I must use durable timers for my product, however on the analysis above I found that birch is not that durable, so it will be a poor material to use for the function allocated to it (bench seat). So to improve the product as much as possible I must substitute birch for better more durable timber, preferably teak as it has a high degree of natural durability.
- I also included the use of the wood oak; oak is a very durable timber however it is very expensive and takes a very long time to grow so this effects the carbon footprint. So I can substitute the use of oak for another wood such as larch or teak.

## Performance requirement:

### • Specification points:

- the product **must** be stable and not fall over
- the product **must** be heavy
- the product **must** be resistant to water and scratches.
- product size and weight **must** vary within the previous weight research

### • Points met:

- Because the bench is 4 sided and each side contains 'legs; that will stand stably, I can confirm that the product will remain stable at all time and will not have a chance of falling over.
- The quantity of wood used will ensure that the product is heavy enough to ensure that it stays stable.
- On the previous slides and points, I mentioned the material that could be used for this product, each material is suitable for exterior use and makes sure that the final product is resistant to rot and scratching.

### • How I can improve the product according to the specification:

- The product weight is meant to vary from what has been concluded from the previous research (slide 17) and the weight of the final product is meant to vary within 17 kilograms and onwards, however because the product is quite big and the quantity of wood used will be quite a lot, meaning the weight of the product might go overboard, this is fine as long as the product int less that 17kg or else there's a possibility of injury(can fall on children who are heavier than 17kg and try to sit on the bench). However the weight of the product should not rise over extent for example (over 70kg) as this will make the product difficult to move around the playground.

On this page I will analyze and evaluate how my design meets the design brief and products specification, I will also justify how I can improve the product to meet the specification points. This will help me develop a final idea for my product. and will help me keep in mind how my final product should meet the specification.

## Material and component:

- Specification points:
  - materials must be environmentally friendly
  - materials should be available in the workshop
  - the product should contain various materials
  - the product must be made of mostly wood
  - other materials like polystyrene and steel could be used but should be used in small quantities

### Points met:

- All the woods used in the product will be from sustainably managed forests (FSC)
- As I will only be able to work on my product in the workshop, I will only be using materials available in the workshop.

### Most of the materials appointed for this product are timbers.

### Ways I can improve the product according to the specification:

- To make this product more interesting I should vary the materials used, wood should be my main source of material however I can include small quantities of other materials, for example, the 4 in a row discs can be made from acrylic , he drawer knobs can be made from vacuumed moulded high impact polystyrene sheets. this will add a more appealing aesthetic to the product instead of making it only of wood.

## What I personally like about this idea:

- What I really like about this initial idea is that it is very interactive, the inclusion on the board games somewhat forces interaction and with this product it ensures that no children play alone during playtime.
- I really like how the board games are ingrained into the actual table and there are drawers specifically dedicated to each board game so that organization is at the highest degree, making the product have a longer lifetime.

## What I can improve in this product:

- This bench seems too big and would probably take a very long time to construct, so if I was to continue with this idea as my final product, I would need to make it smaller yet still include the same pieces and functions.
- I should really consider in depth my carbon footprint, and so before starting to construct the final product need to over analyze every material that will be used and deciding whether its sustainability level is worth its use.

## Scale of production and cost:

- Specification points:
  - production should be no more than £3000
  - I should not spend more than 50 hours making this product
  - manufacturing the product and buying the material should not cost me more than £500
- How I can improve the product according to the specification:
  - In order to decrease the amount the product will be I will need to cut down on the timbers used, for example oak is one of the more expensive woods, so In order to decrease the price of the product I can cut out on the amount of oak used,
  - In order to decrease the amount of time I need to spend on the product I need to decrease the price of the product and to do that I need to use cheaper materials, for example if I want to decrease the price of £3000 I need to use less materials like oak and acrylic.

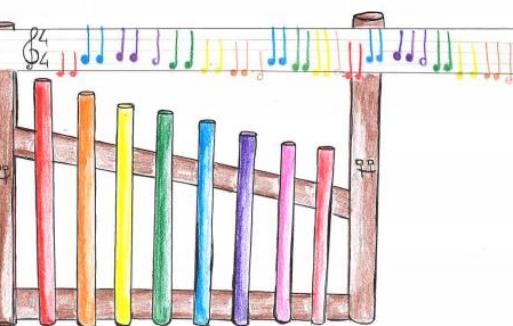
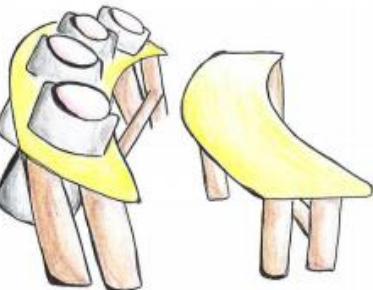
## Does it follow the design brief?

- Design brief:
  - My final product will solve the problem of interaction and organization in a playground. In order to solve this problem, my product will be made for the use of 2 or more children, so it will not be possible for children to play with the product alone, they will need a friend, so this will solve the problem of children being alone during playtime. To solve the problem of organization, the product pieces will be attached to the product so that it will not be possible for the product to become unorganized and it will extend the lifetime of the product.
- Does it meet the design brief?
  - Yes, this product solves the problem of interaction because each of the board games that will be included on the table require two or more children to be able to play the games properly, this will increase interaction during playtime, and hopefully make it more fun. This product solves the problem of organization because the games will be ingrained onto the table, and for the little pieces that belong to each game will be placed I the drawer that is dedicated to the game, this will improve organization in a playground and again expand lifetime of the product.

## Ways in improving the product: Form:

For each product that does not meet my specification point I will outline how I will improve the product to meet my specification.

### design 3:



### Performance requirement:

- **Specification points:**
- the product **must** be stable and not fall over
- the product **must** be heavy
- the product **must** be resistant to water and scratches.
- product size and weight **must** vary within the previous weight research
- **Points met:**
- The 4 legs of the product helps it not fall over.
- The quantity of wood used will help make the product heavy enough to ensure that it doesn't fall over.
- **How I can improve the product according to the specification:**
- Larch wood is resistant to scratching, however because this product will be made of various material not all of the sides or pieces will be resistant to scratching, to help cure this problem, the wood can be waxed to ensure it doesn't scratch easily

- **Specification points:**
- the product **must** include the colours(red, yellow, blue orange, green ,pink and purple)
- the size of the product **could** be 899-1524mm (length) and 965.2mm (wide)
- the product **must** be colourful and organized
- the product **should** be fun and interactive

- **Points met:**
- The product includes the colours (red, yellow, orange, green, pink and purple)
- All the measurements vary with in the range of 899-1524mm
- The product is indeed colourful and organised (mallets stored on the side, all tubes inside the product itself)
- It is interactive because it requires more than one person to play at a time to compose the nursery rhyme

### Material and component requirement:

- **Specification points:**
- materials **must** be environmentally friendly
- materials **should** be available in the workshop
- the product **should** contain various materials
- the product **must** be made of mostly wood
- other materials like polystyrene and steel **could** be used but **should** be used in small quantities

- **Points met:**
- Larch ,birch and MDF are all environmentally friendly.
- All materials used in the process of making this product are environmentally friendly.
- Acrylic will be inserted inside the tubes to form the sound,
- Throughout the process of making this product, various material will be used to help make the product come together.
- Wood is definitely the main material used.
- **How I can improve the product according the specification**
- Steel can be used to make the mallet holders

### Scale of production and cost:

- **Specification points**
- production **should** be no more than £3000
- I **should** not spend more than 50 hours making this product
- manufacturing the product and buying the material **should** not cost me more than £500
- **How I can improve the product according to the specification:**
- In order to decrease the amount the product will be I will need to cut down on the timbers used, for example larch is one of the more expensive woods, so In order to decrease the price of the product I can cut out on the amount of larch used, and use more of MDF as it is made from remaining wood dust making it cheap.
- In order to decrease the amount of time I need to spend on the product I need to decrease the price of the product and to do that I need to use cheaper materials, for example if I want to decrease the price of £3000 I need to use less materials like larch and acrylic.

On this page I will analyze and evaluate how my design meets the design brief and products specification, I will also justify how I can improve the product to meet the specification points. This will help me develop a final idea for my product. and will help me keep in mind how my final product should meet the specification.

### Function:

- **Specification points:**
- the product **must** be made of durable timbers that can handle outdoor weather conditions and should be immune to insect and rot.
- the product **should** contain some sort of structure that allows the product to be organised
- **Points met:**
- The main timbers chosen for this product are (larch, birch and MDF ) MDF is a durable timber, It is as durable as natural timbers thanks to technology, and is also a good sustainable alternative because it is made from remaining wood dust. Larch is both tough and durable making it ideal for exposed elevations and areas where knocks and scrapes are likely. These are great properties for my product as it is based on exterior use and children where it is most likely to get scratches. Birch is a strong and durable timber, and due to its strength and light weight it is good for supporting large structures
- the structure of this product helps it become organized, the mallets will be stored on the side and all pieces of the product are attached to the product itself meaning they will not be able to get lost and pulls the whole product together as a whole.

### User requirements:

- **Specification points:**
- the product **could** be knock down fitting
- the product **should** be no less than 10 k and no more than 30 kg.
- the product **should** not be too complex
- the product **should** be rounded and safe.
- **Points met:**
- The quantity of the wood that will be used, will ensure that the product is no less than 10k
- The product will be very easy for children to understand how to use the product.
- All the sides and any possible pieces of the product that have the possibility of being sharp will be rounded. Making it safe for the younger children to play with the product.
- **How I can improve the product according to the specification:**
- This product can be a knock down fitting, by making each piece as I normally would but ensuring that it could be nailed, by doing this to every piece, it will be easier to ship and easier for the buyer to assemble with less hassle and maintenance

## **Does it follow the design brief?:**

- **Design brief:**
- My final product will solve the problem of interaction and organization in a playground. In order to solve this problem, my product will be made for the use of 2 or more children, so it will not be possible for children to play with the product alone, they will need a friend, so this will solve the problem of children being alone during playtime. To solve the problem of organization, the product pieces will be attached to the product so that it will not be possible for the product to become unorganized and it will extend the lifetime of the product.
- **Does it meet the design brief?**
- This product does meet the design brief because it solves the problem of interaction and organization in a playground. . This product has a kind of a 'seesaw' effect, where it requires two or more people to be able to function the product properly, the product contains a nursery rhyme that children are required to work together to compose it, this solves the 'interactive problem'. The main aim of this product is to help children have fun through music, in which they can find their love for music, by joining both products together to form one, it will solve many problems in a playground, and it will be a new kind of product for the playground which will excite children.

## **What I personally like about this idea:**

- I really like how I included a nursery rhyme in this idea, as it requires children to work together to compose the song and how they will get something out of working together( the song)
- I also really like how each note of the song has a tube dedicated to it, this will make it easier for children to play with the product.

## **What I can improve in this product:**

- By joining the two products together I am sure that it will form and even nice product and meet more of the specification points.
- The children really liked the aim of this idea so it shall be the focus in the development stage.

## Development stage

As my problem is based around children, I thought it would be suitable for children to decide what idea they think should be developed further and be produced for their playground. The following are interviews I had with children analyzing my product.



9-year-old girls in y5



11-year-old boys in y7

**Interviewer:** hi, how old are you guys?

**Children:** hi, I'm Sarah and she's Sama , we are both 9 years old in year 5

**Interviewer:** looking at all three designs which one is your favorite?

**Children:** we really like the bench idea because me and my friends usually spend time together in the benches, so a game on the bench will make recess more entertaining and we won't get bored as fast, I also like the idea of organization because the younger children always leave the benches a mess after them, so this will help. We also really like the connect three game because it seems fun and the idea of having the discs connected to the board itself is clever and cool. However our favorite is the instrument idea, it is something that is not usually found in the playground, so having it in the playground will be very fun and new and the idea of having the nursery rhyme notes allocated to a tube is very clever and we are sure that children of all ages would enjoy playing with it, the colors included in all the ideas are also really nice. Anyways we really like all three ideas but mostly the instrument idea, so if you include different piece of each idea to the instrument idea it will be even better. And we also think that the colors used are very pretty and make the product look very nice.

**Interviewer:** thank you for your time.

**ratings given by the girls for each product:**

Design 1: 7/10

Design 2: 7/10

Design 3: 9/10

**Interviewer:** hi, how old are you guys?

**Children:** hi, I'm Jad and Mohamed and we are 10 years old in year 7

**Interviewer:** looking at all three designs which is your favorite?

**Children:** we really like the instrumental idea because it is very new to the playground and it would be very fun to play with, the bench idea is nice but we wouldn't really use it because we would rather run around and make noise rather than sit down all of lunch time, but it seems like a cool idea and a change to the normal benches we have in school. Our favorite is the connect three game because it is competitive and seems like it would be fun to play with, with our friends. we like all three ideas, but our favorite is probably the connect three and musical instrument, so a join of both games will make it even nicer.

**Interviewer:** thank you for your time.

Ratings given by the boys for each design:

Design 1: 9/10

Design2 : 3/10

Design 3: 6/10

### Summary of the interviews:

From the interviews we can tell that the children would much rather play with design 1 and 3 (connect three, and instrumental bench) so to fill the children's needs design 1 and 3 will be taken forward mainly focusing on design 3 and improving it to fill children's wishes.

Overall all three idea offer a different direction to the original problem established, some are more suited for the requirements and purposes than others, I will try to create a model that displays the most desirable characteristics from all three ideas, but most influence will mainly come from idea 1 and 3, as according to the clients interviewed they are the most favorable.

On this page I will be determining which design will be taken forward to further development. To do this I have interviewed a few children of different age groups, showing them all three initial ideas and asked them a couple of questions about the product, by doing this it helped me decide which idea should be taken forward according to what children will rather have in their playground.

**Most favorable design:**

**First place:** design 1 (16/20)

**Second place:** design 3 (15/20)

**Third place:** design 2 (10/20)

## Development of design ideas:

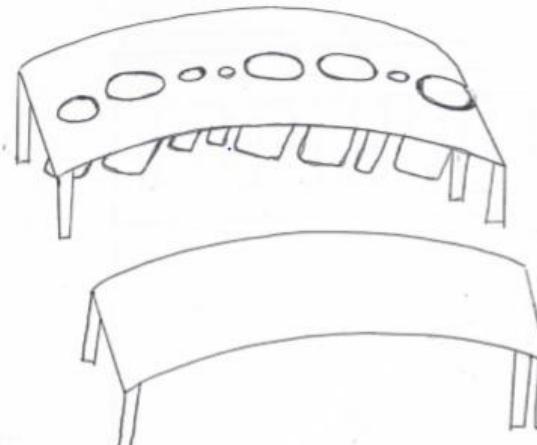
I chose to take forward design 1 and 3- however I also like the idea of the ingrained games on the bench from design 2 so I have decided to take that forward as well and influence that idea onto the developed prototype. In the developed porotype i will be creating a new design by joining the 3 ides together to form a better product that further meets the specification points. Before creating a new design I will analyze what parts of each design I like and what can be improved to make the final design the best it could be, although this has already been done in the previous slide, the upcoming analysis will be very short and brief, so it just underlines the key points of improvements.

On this page, I will be taking forward the 3 ideas and developing them to fit the design brief and specification points better, I will be analyzing potential materials that could be used, along with the dimensions and the aesthetic of the product, the reason to doing this is to create a prototype that best fits the design brief and kids preferences , and to potentially come up with a final prototype for my client.

### Design 1:

- What parts will be taken forward:
  - I really like the idea of having a game ingrained onto the board and how the discs are magnetically connected so that idea will be taken forward.
- What needs to be improved In the parts taken forward:
  - There are concerns that the use of oak is not very sustainable, and causes environmental issues, so to an extent I should minimize the use of oak, and if it is necessary to be used, I should only use it in small quantities.
  - In order to decrease the amount of time I need to spend on the product I need to decrease the price of the product and to do that I need to use cheaper materials, for example if I want to decrease the price of £3000 I need to use less materials like oak and acrylic.
  - This product got a whole rating of 16/20 (sum of rating between the boys and girls) however the reason it lost 4 points is mainly because of its aesthetic, the colors chosen need to be reconsidered.

Brief ideas of how the prototype can be developed



The bench can include more tubes, so the idea of having a nursery rhyme can be included, by having more tubes, it means the bench will be bigger creating that seesaw affect where it requires more than 2 children to play the product at once

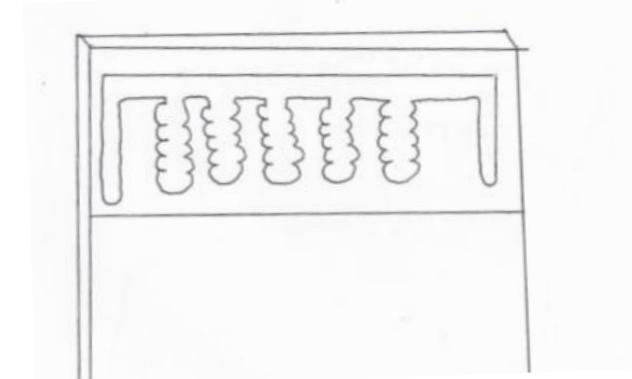


The musical notes can be placed on a banner-like board, which can be connected to the bench, so instead of standing children can just sit down and play the notes.

### Design 3:

- What parts will be taken forward:
  - I like the idea of including a nursery rhyme to the product as it gives the product a further aim, and how each note has a tube allocated to it, making the product appealing.
- I also like the bench design and how it has a 'seesaw' effect to the product, so children are obligated to work together
- What needs to be improved from the parts taken forward:
  - Since there will be a standing board that contains the musical notes, I can make the product multi use by adding another piece of one of the ideas to the back of the board, for example the connect 4.

The main specification points that will be focused on in the developed prototype are (performance and requirement, material and component and sustainability) since the other spec points we met in the initial ideas, I need to focus on the mentioned spec points to develop and modify the new prototype to the maximum extent.



Since there will already be a board like structure, we can easily make the game multi use buy bringing the connect 3 idea and placing it on the back of the board, and since the board will be wider, instead of 'connect 3' it could be for example 'connect 5' making the game last longer.

# Development of design idea into chosen design

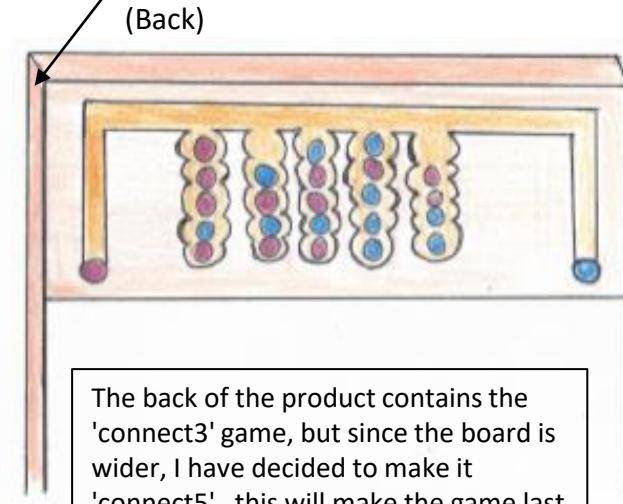
The following designs are a few ideas of how I can develop the design ideas to fit the specification points and design brief better

Where the information cards will be

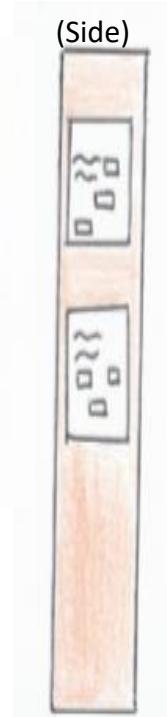
(Front)



(Back)



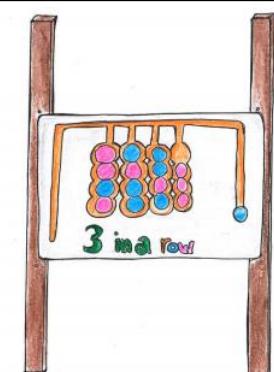
(Side)



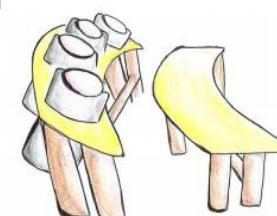
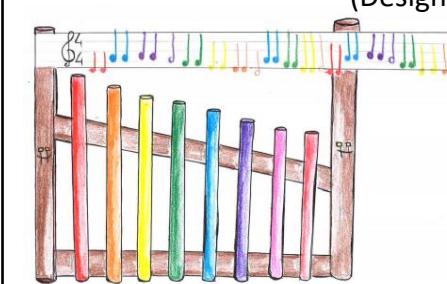
Information cards demonstrating the use of the product( mainly contains picture), ( the writing will be in English and Arabic-English because the school I'm designing this for runs a British curriculum so the main language is English, and Arabic because the product will be based in the UAE, and the language based around the UAE is Arabic

Initial ideas taken forward

(Design 1)



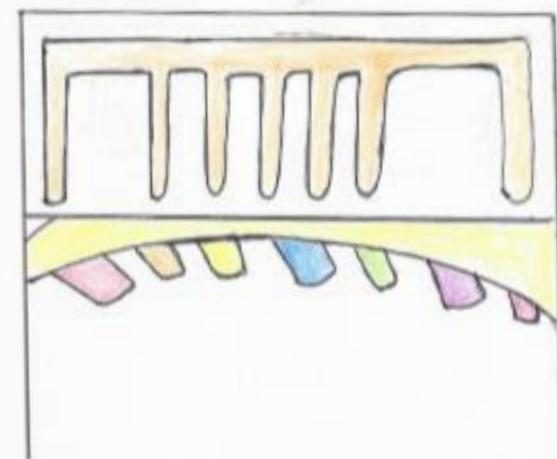
(Design 3)



(side view)



(back view)



## Description of how the ideas have been developed:

Since the children preferred idea 1 and 3 I decided to take those ideas forward and try to make a new design and developed it to fit the specification points better.

I kept the idea of having a curved bongo bench, however instead of only having 4 cylinder musical tubes I incorporated the idea of having nursery rhyme, and with each different note it had a musical tube allocated to it (you can tell which tube is for which note by the color, e.g. the red musical notes has a red musical cylinder) so that resulted to 8 tubes instead Of 4.

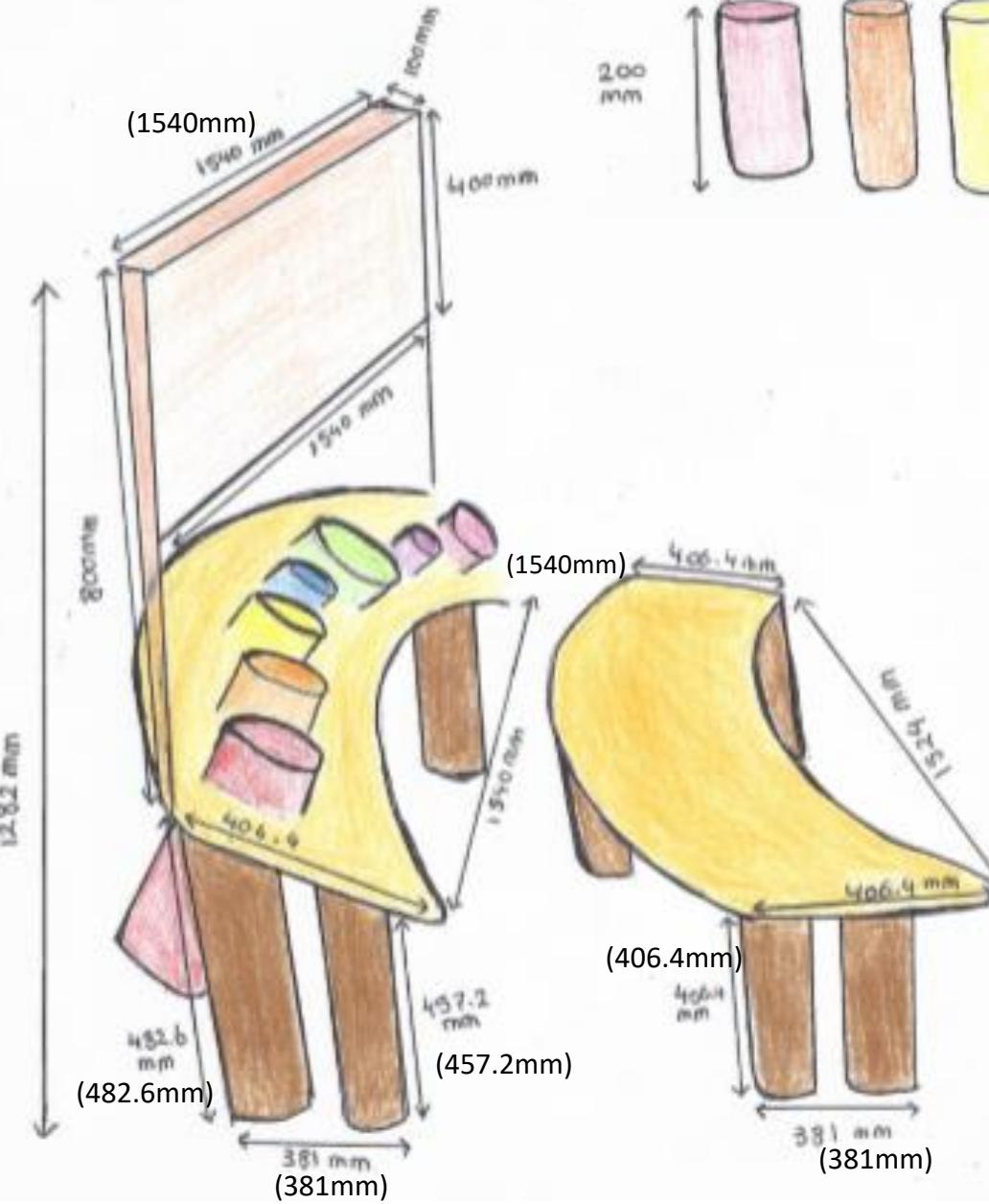
Instead of having the nursery rhyme high up, I decided to incorporate it to the design and join it to the bench as though it was like a banner. Since there was already a 'banner' like piece, I incorporated the idea of the 'connect 3' to the design, but on the back, so the product could be multi-functional. On the side of the product, it contains 2 information cards about each side of the product, this makes it easier for children of all ages to understand how to use the product . (the information cards will mainly contain pictures to demonstrate the use of the product)

## Aesthetic:

The children really liked the use of color in the design, so continued with the idea of using color, however to keep the product elegant looking, I made the bases of the product neutral colors (yellow, brown and beige) and for the smaller pieces of the design I used more vibrant colors (red, pink, orange, blue, green, purple) to give the product a pop of color and attract children's eyes to the product (previously mentioned on page 16).

On this page, I will be brainstorming some designs that could develop the previous designs and help meet the spec point further.

## Approximate measurements



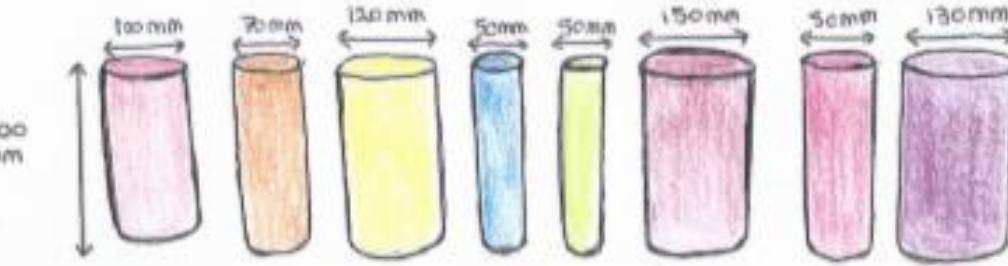
### Materials being used:

**Beech:** (will be used for the bench seat and table) because it is strong, heavy, hard, good strength properties and high abrasion resistance, and most found wood in the workshop.

**Pine:** (for the bench stand) because it is a , renewable resource, easy to work with, resistant against decay and rot, durable and strong. These characteristics are suitable for the bench stand as the stand will be in contact with a lot of pressure, insects and potentially rot.

**MDF:** (for the musical cylinder) as MDF can be easily curved into shape, it is cheap, smooth, renewable.

**Cedar:** for the ('banner' containing the musical notes and connect 5)cedar is a naturally durable wood making it perfect for all outdoor projects. The wood is lightweight and valued for its high natural resistance and decay properties. It is less susceptible to moisture, insect damage and fungi growth.



All the cylinder tubes will be the same length, but their diameter will be different for each tube, and the size of the acrylic inserted into the tube will be different for each tube, to enable different sounds to be produced at different pitches

### Material overview:

Another change that has been made to the product comes in terms of the material. As we have established in the past the product should be made of the most sustainable timbers and materials (to an extent), and when I have come to review my initial ideas I found that not all the materials chosen met the sustainability level required (oak) the materials chosen also need to be water, insect, scratching and rot resistant, as this product is based on exterior use, it needs to meet the resistant criteria to ensure that its life span will last long and wont wrap or twist due to environmental causes, the materials chosen also need to be strong to withhold pressure and weight of children.

The original materials chosen were:

- Larch- bench stand
- Laminated and curved MDF- musical cylinders
- Laminated birch- bench seat and table.

To find the best alternative woods that can be used to manufacture this product, I did some research on the most durable timbers to outdoor conditions and what woods are usually used in manufacturing outdoor benches.

The most common woods used (most durable) are

- Cedar
- Pine
- Teak
- beech

So, from the research conducted and previous woods used, I need to choose varieties of woods to use in each piece of the product and state how its properties will help the product perform its job.( woods used also need to be those found in the workshop) (all the woods found in the workshop are sustainable –FSC- but how long it grows and the woods rareness is being taken to account during material choices to ensure that carbon footprint doesn't increase through the manufacturing of my product.

### Size:

I was going to adjust the size of the product, however for the product to function as it is meant to, needs to maintain the size that it is, while developing this product, I have found that it is too big, and manufacturing it would take too long, and so it would not meet the hand in date.

Since finding a problem in developing this idea, I have decided to leave it at the stage that I have finished at and make a new developed product that better meets the criteria.

On this page I will be analyzing my first developed idea in detail (size and aesthetic)



beech

pine

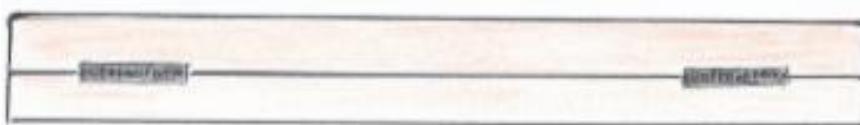
MDF

cedar

## Development of design idea into chosen design

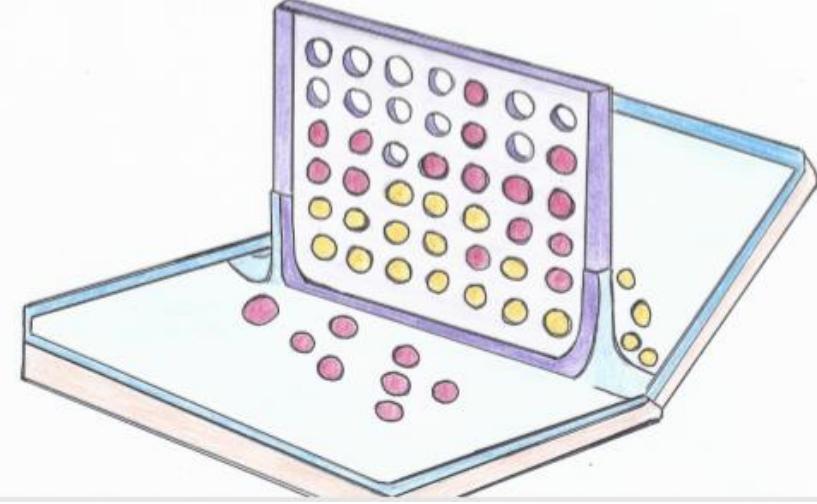
As I have discovered in the previous idea developed, the product scale was too big and so it would be over ambitious to manufacture a product this big with the amount of time/day given to complete the manufacture. So instead of producing a product from scratch, I have decided to develop an idea that could help improve already existing product(small product, with bigger worth).

(Back view of the product)

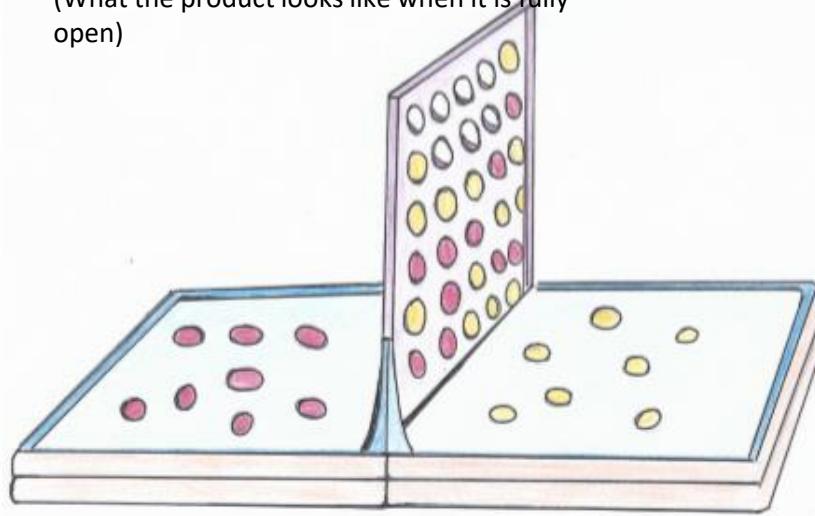


On this page I will be developing a new product that better fits the criterias given. I will be producing sketches to demonstrate ideas of how I can develop the initial ideas

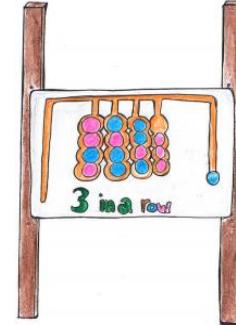
(What the product looks like when its being opened)



(What the product looks like when it is fully open)

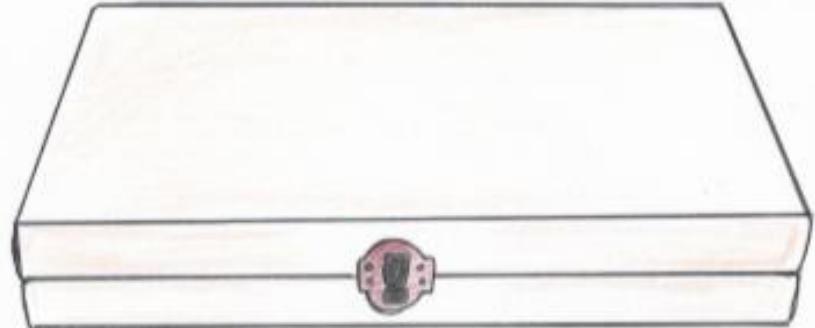


Initial idea taken forward:

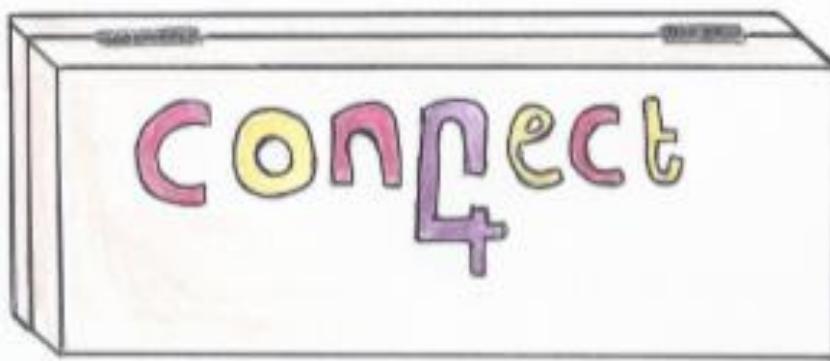


The reason I have decided to only take this initial idea forward to be developed, is because there are many more possible small-scale pieces to produce from this idea, it was also one of the more favored ideas according to the children.

(What the product looks like closed)



(Potential design for the product)



### Description of the idea:

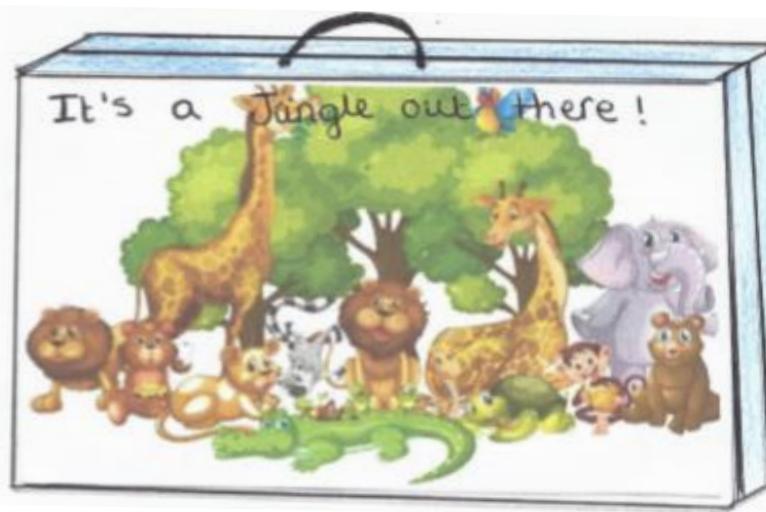
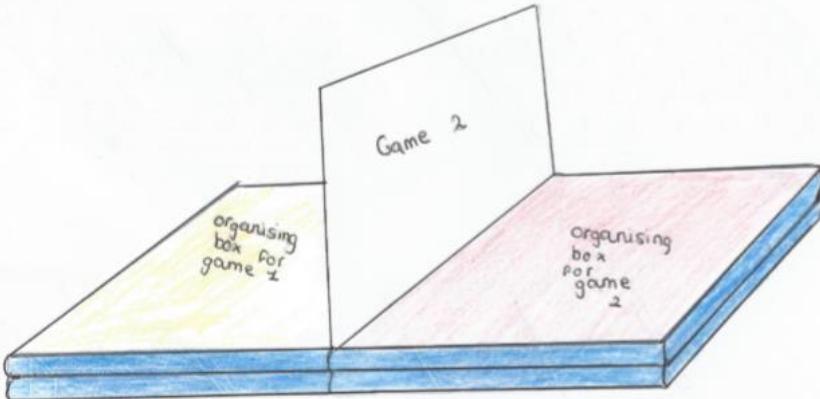
I decided to take design 1 and develop it into a smaller scale product that can help develop already existing product (benches). The sketches above show how the product might potentially look. The idea of the product is an adjustable product that could be used anywhere around a playground (preferably a bench). The design is a 'book' like box, that when it is opened you will find the connect 4 game already set up ready to be played. The product will remain organised because the main piece (the board) is manufactured into the box, the only time it can be moved is when the game is finished, the board can be moved up, (but only to a certain extent) to allow all the discs to fall down from the board in to either side of the box. (the disc organization will be talked about further in the next slides).

### How the product has been developed:

I took the idea of the drawers from design 2 , and found of way of developing it into a product. Since a drawer was used for keeping places tidy and organised, I used that idea into developing this current product. However instead of a whole drawer, I turned it into a box that can be more suitable towards the playground as it can be used anywhere during playtime.i kept the idea of connect three, but in a different way.

After developing the initial idea (previous page), I was unsatisfied with the outcome so decided to develop the product even further, but this time to make it look nicer, I would have a theme so everything would look more put together (animals and wildlife, since all kids of all ages like animals)

## Aesthetic and function:



On this I will be developing the design I previously developed (previous page) even more so that it can meet my satisfaction along with the children's

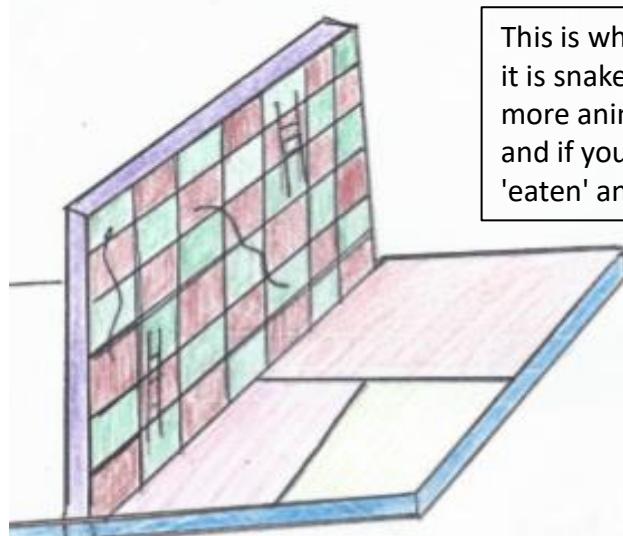
Cover of the box, since the theme is animals, I decided to include most thought of animals as the cover, this will interest children into the product.

I have a few ideas of what the name of the game can be, still following the theme of animals, (the way that the name will be laid out hasn't yet been decided and will be shown in later slides.)

1. Games in a box.
2. It's a jungle out there
3. A trip to the zoo

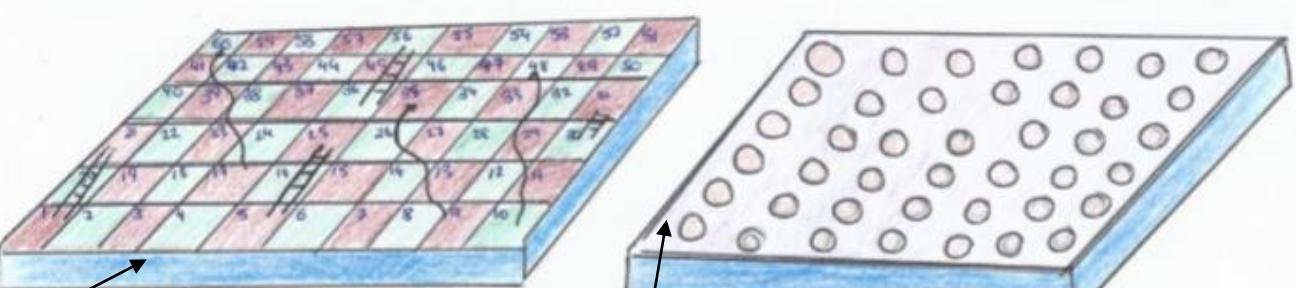
I still followed the same idea from the previous slide, but what has changed is the way the product will function, I also decided to continue to use the idea of having a multi-functional game.

The way the product will function is that it will open as a box, and a frame will be standing upright, on either side there is a different game, the frame can be pulled up slightly and then laid down so it is covering the "organizing box" bits, the frame will lay down completely flat and so can be played as a normal board game would be played.

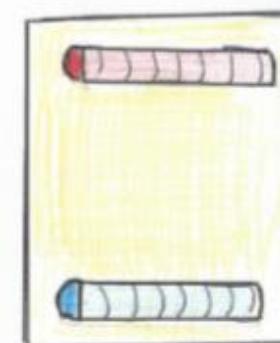
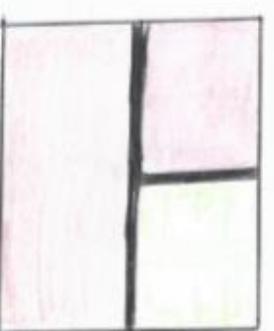


This is what the first game will look like, it is snakes and ladders, but will include more animals in it, for example ( a lion, and if you land on the lion you are 'eaten' and so lose the game)

What the games will look like when they are completely flat on the box

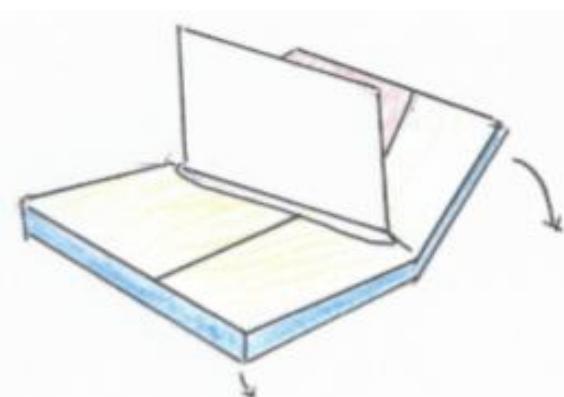


A brief look of what the product looks like while being opened



Instead of having the 'connect 4' be rolled down columns, I decided to make it as though they are holes that the discs are inserted into, so they lay on the surface of the board, this develops the idea of connect 4.

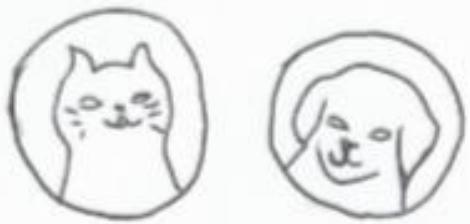
For the snakes and ladders, the box will be divided into three, so the dices can be put into a slot, as well as the discs and other pieces of the game, it will also contain an acrylic lid on top that closes keeping the box safe from becoming unorganized when lifted or closed.



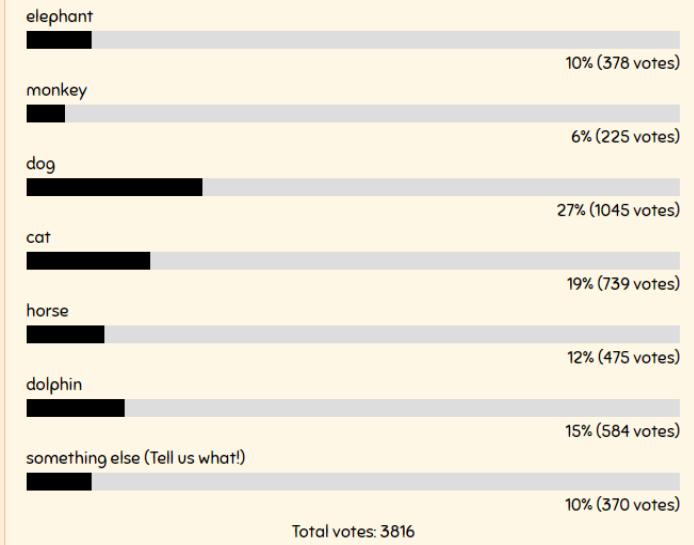
This is the way that each side of the box will be organized, the left side is the way that the snakes and ladders game will be organized and, on the right,, it is the way that the connect 4 game will be organized.

For the connect 4, there will be two slots, for both discs, the slots will be ingrained into the wood so that when the discs are inserted into them they maintain there when the box is closed, there will also be an acrylic lid that closes on top of the organizing place to make sure nothing becomes unorganized when the box closes.

Aesthetic development continued on the next page.



Instead of having plain colored tokens( for the connect 4 game), I decided to adapt the tokens more to children's like and make it something they would like, but to continue with the theme of animals I stayed with the idea of using animals as the token design, however to decide what animal would be used, I conducted some research on what animals kids like the most and the result was , most liked 1) dogs then cats.

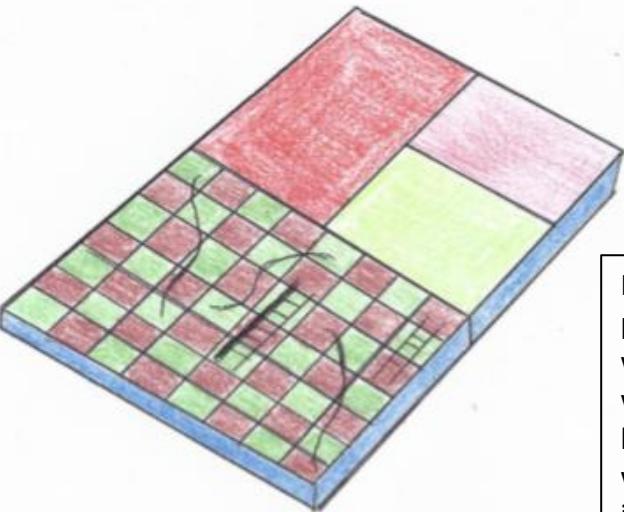


This is the result table that I have used to decide the animals for the discs, the research has been conducted by the British counsel and they asked a total of 3816 children

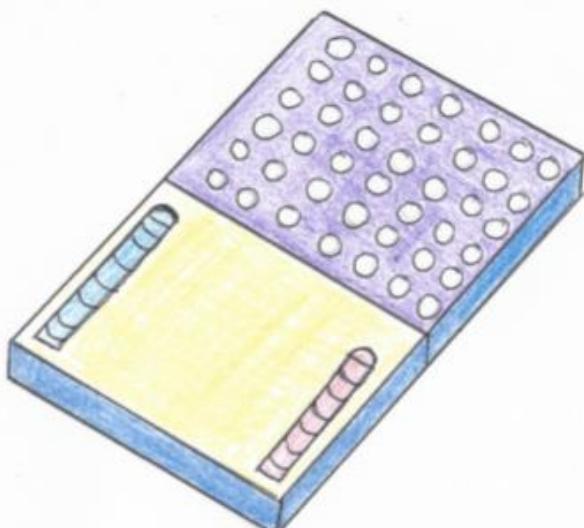


The color of the discs hasn't been decided yet, it will be decided once the color of the whole product is final to ensure no similarities in color.

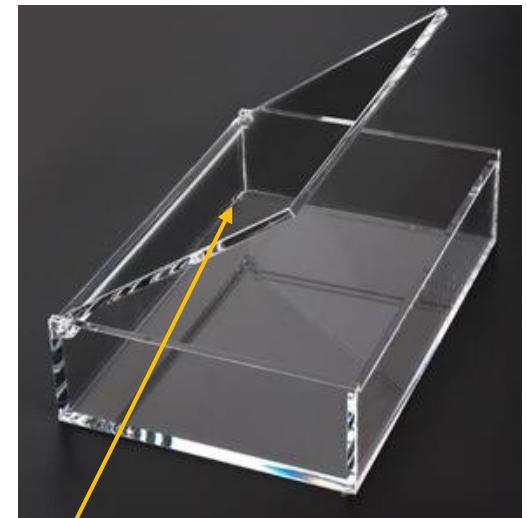
For the tokens in the snakes and ladder game I decide to use wildlife animals to contrast with 'house animals' and to go with the of 'snakes' in 'snakes and ladders' a few examples of the wildlife animals that can be used are shown above.



I have developed the design so that when it is laid flat it fits the box properly, it will lay flat on the opposite side of the organizing box so that while the children play the game they can access the game pieces easier without having to stop the game or restarting it. This meets the criteria better, as now the product can remain organized while it is being played with as not all the pieces required to play with have to be taken out, instead they can be taken out one at a time.



What I have come to realize before analyzing the dimensions that could be used, is that for the board to lay flat when opened, then stand up right when closed, is that it wouldn't be possible to find a size that fits in both those category's, as, if I were to make the board so that it laid flat it would have to be the length of the total product not allowing it to close properly when standing upright, and if I was to make it that it stood upright when it is closed it wouldn't lay completely flat and there would be spaces where the board doesn't meet the products length, ruining the aesthetic., so I have done some further developments to my product to make it suitable to fit both those functions.

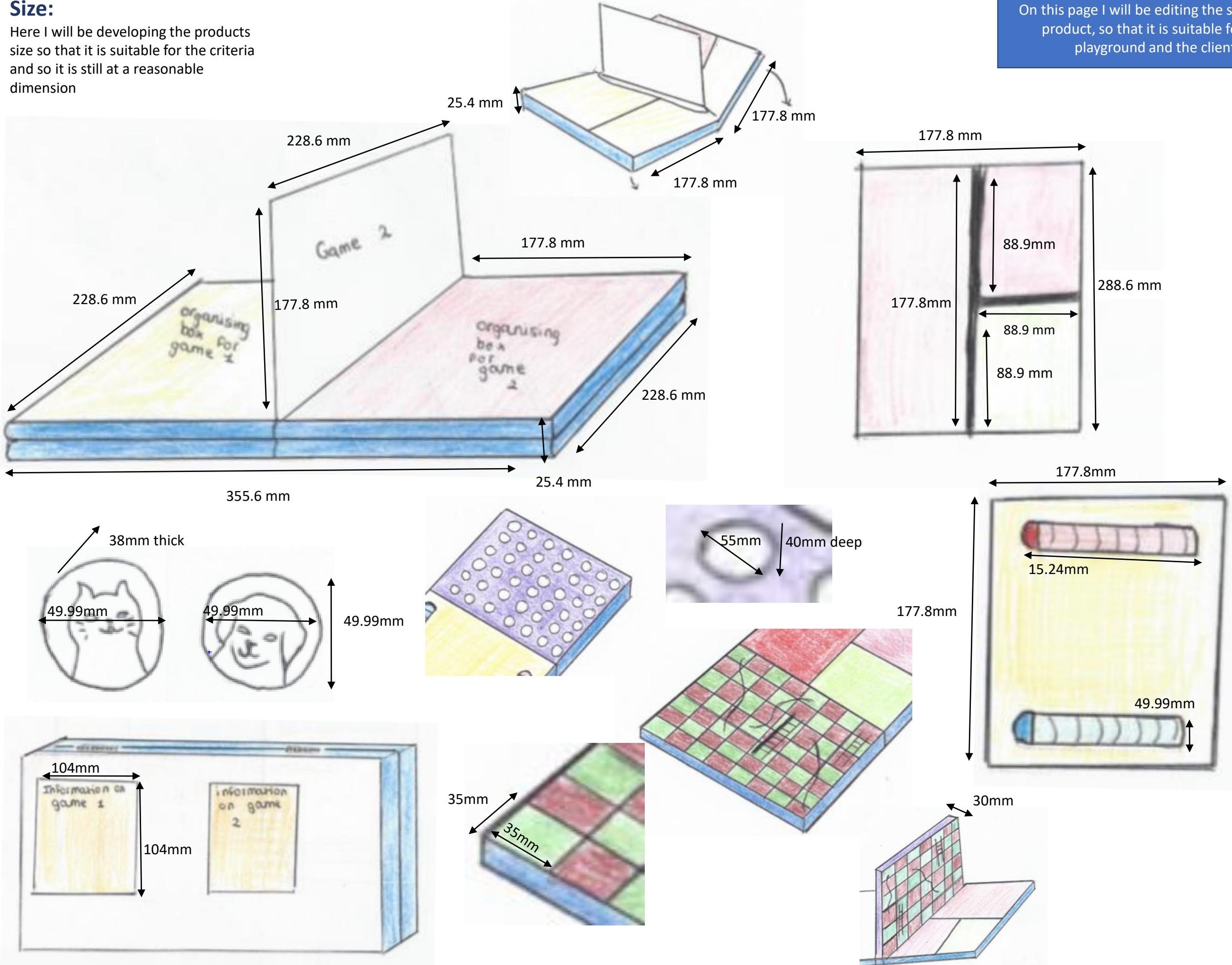


This is an example of what the acrylic lid would look like, it would be a thin acrylic piece that would be added to the product from the inside, it can be opened to remove pieces needed from the game, this helps maintain the organization of the product.

## Size:

Here I will be developing the products size so that it is suitable for the criteria and so it is still at a reasonable dimension

On this page I will be editing the size of the product, so that it is suitable for the playground and the client

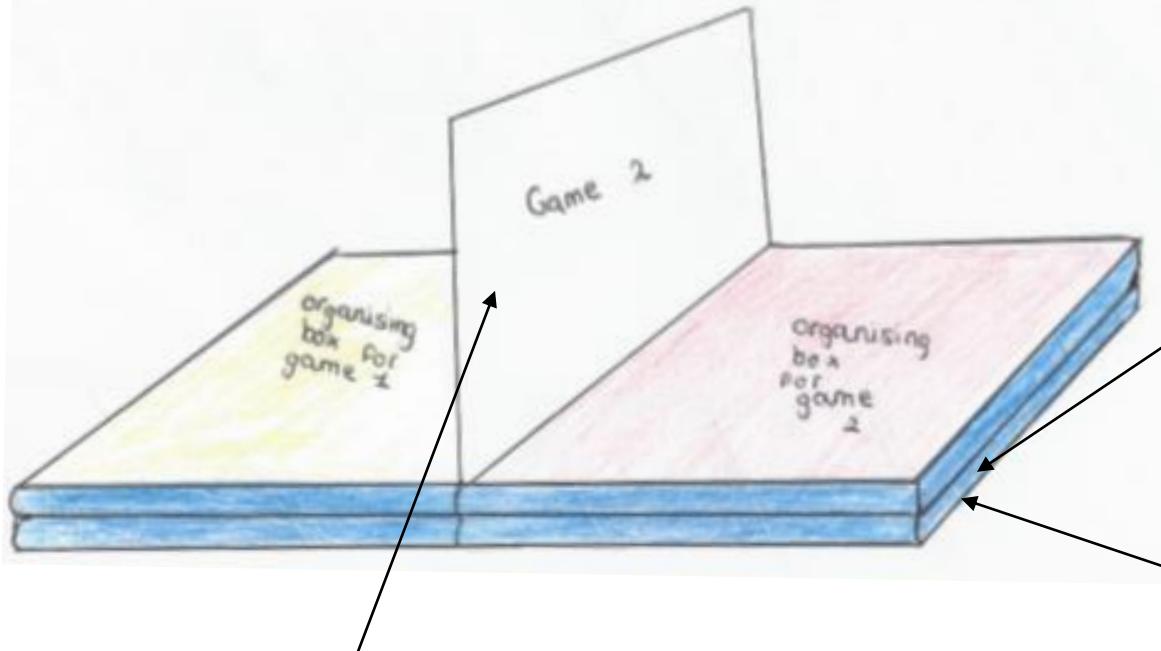


# Materials:

I need to make sure that the materials I use for my products are lightweight, since the product is a box that can be carried around by children I need to make sure that I use woods that are light weight to ensure that it is easy to be moved around.

The main timbers that will be used are Balsa and MDF mainly because they are very light weight and easy to work with.

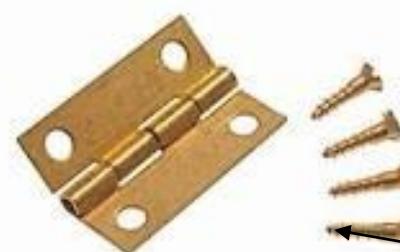
On this page I will be choosing the materials that will be used for the product



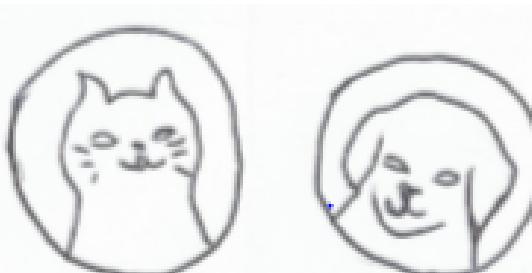
The board can be made from pine, pine is very lightweight and inexpensive, the board frame also doesn't require as much strength as the box base, as it is protected inside the box.

The cover (base) of the product can be made from Balsa because balsa is very light weight and inexpensive and very easy to work with. Since the base of the box needs extra protection as it will be in contact more with the surroundings than what is inside the box, so to provide extra strength to the product I can veneer it to make sure it maintains its strength and holds the product together.

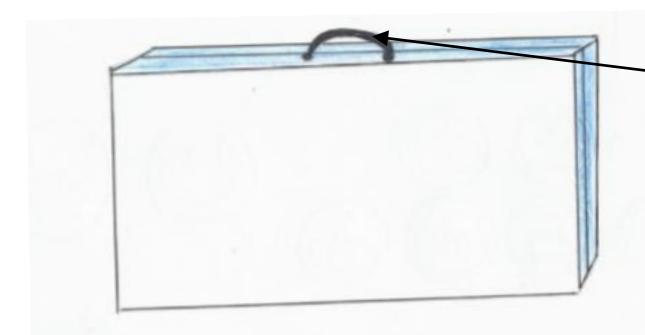
Another alternative to balsa can be MDF, MDF is dense, strong and durable, so it can provide the product with the properties necessary.



Hinges will be used to connect the two sides of the box together, like the example given on the bottom left.

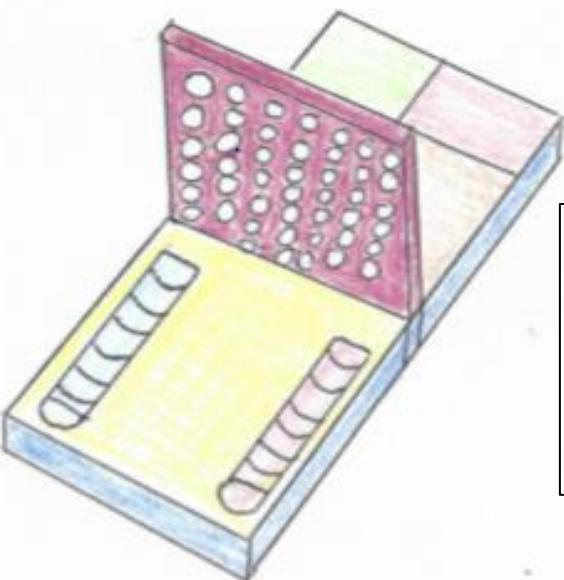


The discs can be made from acrylic, to further add an appeal to the aesthetic instead of making it only timber.



The handle can be made from oak, since oak is very strong and handles pressure, and the handle will be holding the weight of the whole product when children carry it.

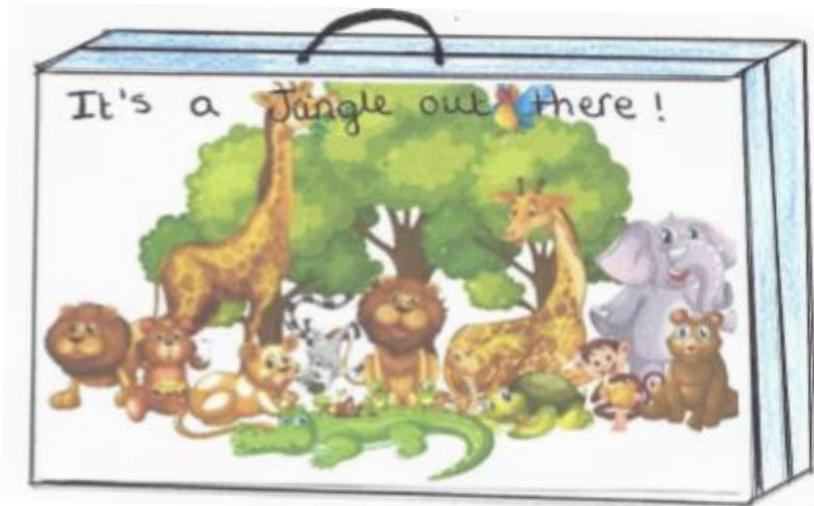
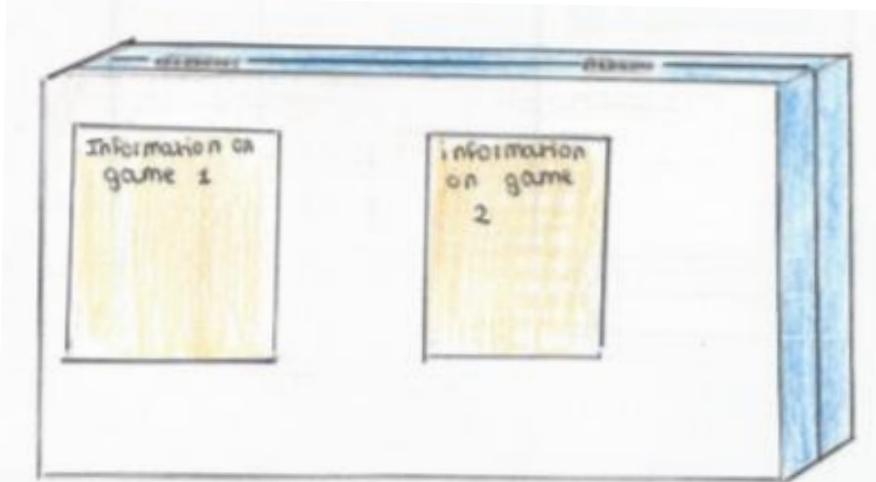
# Final product:



On this page I'm deciding the final aesthetic and color of the product. I decided that not every piece of the product was not going to be a vibrant color from the ones mentioned before as this will disturb the aesthetic of the product and make it look too neon and unprofessional, so for the bases I used neutral colors, and the smaller parts I used more vibrant colors.

On this page I will be showing what the final product will look like (and color), as there has been many developments made. This will make it easier to identify what the final product is.

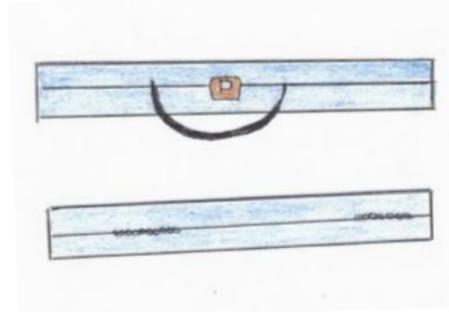
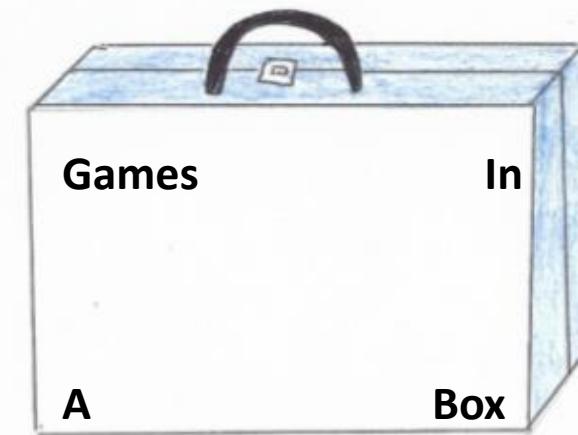
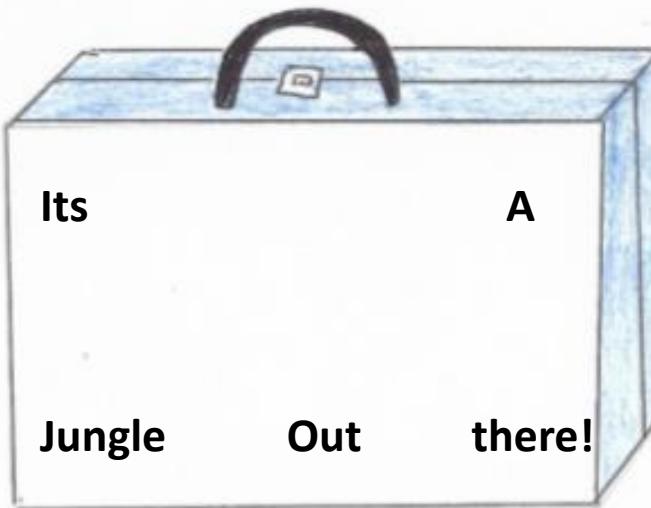
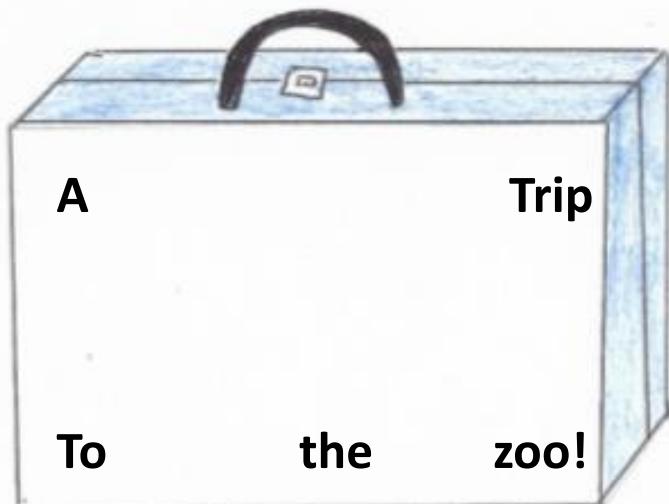
The main board will be a light purple, except for the snakes and ladders game which will be checkered light maroon and green. The disc columns will be red and blue and the organizing box for the snakes and ladders will be red blue and green.



This is what the product cover will look like, but in terms of the name, it hasn't been decided yet, but this is how the product will look like with each name. (children will decide which name is their favorite)

The image itself will be ingrained onto the wood, as for the name each letter will be cut out individually and stuck to make it look like its popping out.

The back of the product will contain information cards so that it is easier for the children to understand how to use the product.



As for the discs I decided on using gender neutral colors, but also colors that contrast well together so it is easier to spot the difference between them.

# Development of design ideas into chosen design:

The models shown on this slide and the next few slides are very rough models as it will make it easier to develop faults and identify them.

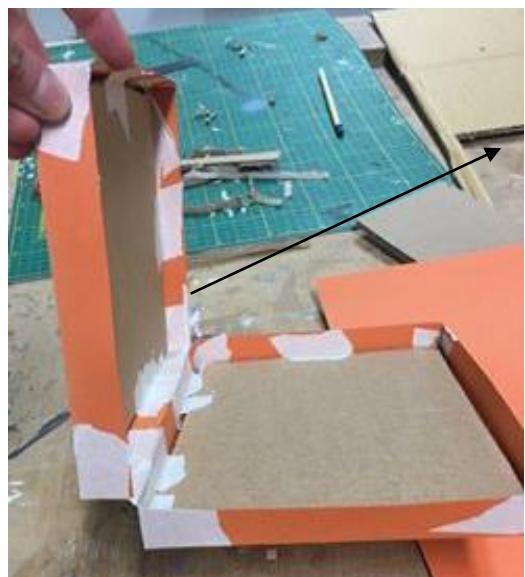
\*highlighted sentences are the developments required in the product\*



The first thing I did was use the exact measurements identified in the development to cut out 2 nets and form the box.  
The first fault I identified was the size of the whole product, it seemed to small and so the first development would be to increase the size of the product.

On this page I will be modelling my developed design as well as focusing on the smaller components to identify how the final design will be made, I will also be identifying faults in the development that could be developed further.

2



The second thing I did was connect the box together. (the tape acts as the hinges), the problem that occurred to me was how I was going to place the board in the middle of the box the it would be too thin to place the box and the mechanism of moving the board wouldn't work.

So the second development from the faults identified was to find a way the board can stand and carry out its mechanism properly.

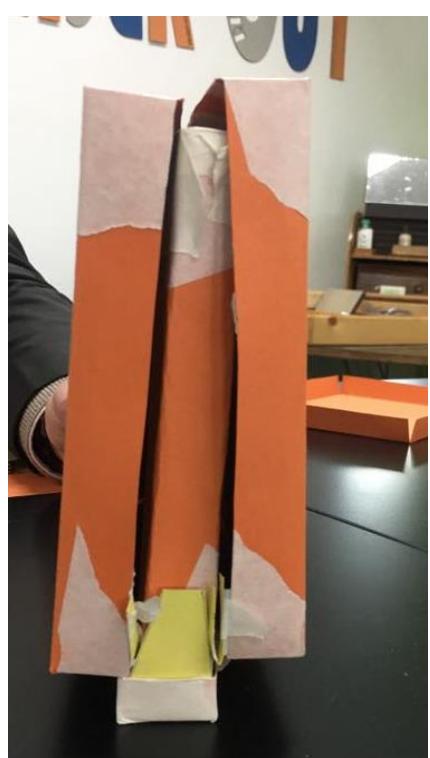


3



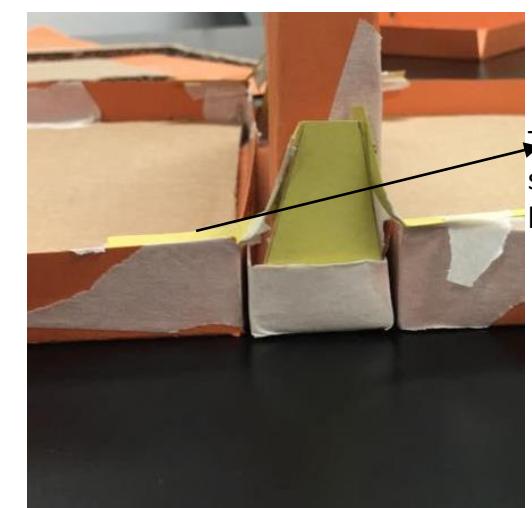
To overcome the board problem, I have decided to overcome the problem by inserting an extra piece of rectangular card which is where the board will rest when the box is closed.

4



The next problem I have faced is that when closing the box, the extra piece of card used for the board stops the box from closing fully and lays on the bottom of the box making it unappealing

So the next development that had to be made to the model was to find a structure that allows the box to close efficiently while still maintaining the purpose of the product.



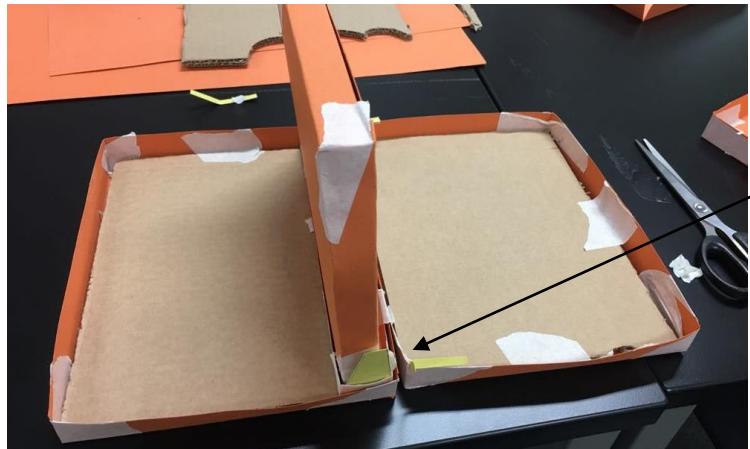
The yellow piece of card is the what will hold the board in place, it will also be connected to a dowel like component to allow the board to slide into the other sides of the box.

The thin yellow cards are the dowel like structure that acts like a track for the board and helps it slide easily.

# Development of design ideas into chosen design:

On this page I will continue to identify faults in my developed product so that I can develop it further and find solutions to occurring problems.

5



To solve the problem of the box not closing properly and the unappealing aesthetic of the extra wood for the board, I have decided to place that piece inside either one of the sides. This will be its permanent place and where it sits when the box is closed (the function of the moving board will continue)

But now that I have found a solution to the main problem, the box will need to be edited slightly to fit the function more easily. for example

- The whole box will need to be bigger in order for the board to be laced inside one of the sides
- The board size will need to be smaller, so that it can lay flat.
- The boards mechanisms will need to be edited slightly to fit the development.



The board will need to be smaller so that when it lays flat so that it can be played, it will fit exactly the size of the box.



The mechanism of the board will stay the same, but instead of it being in a fixed position, the side of the mechanism will have to be flexible so that it allows the board to lay down when closing the box.

Summary of further developments that need to be done to the product:

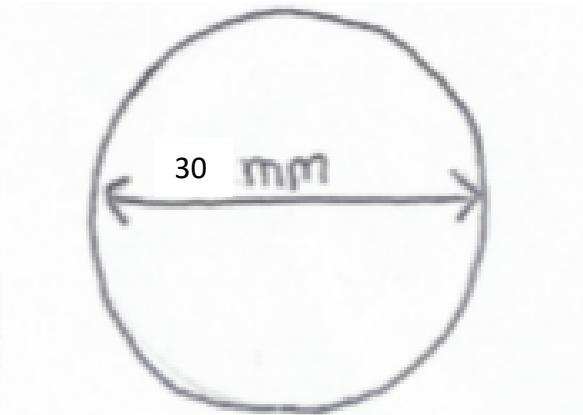
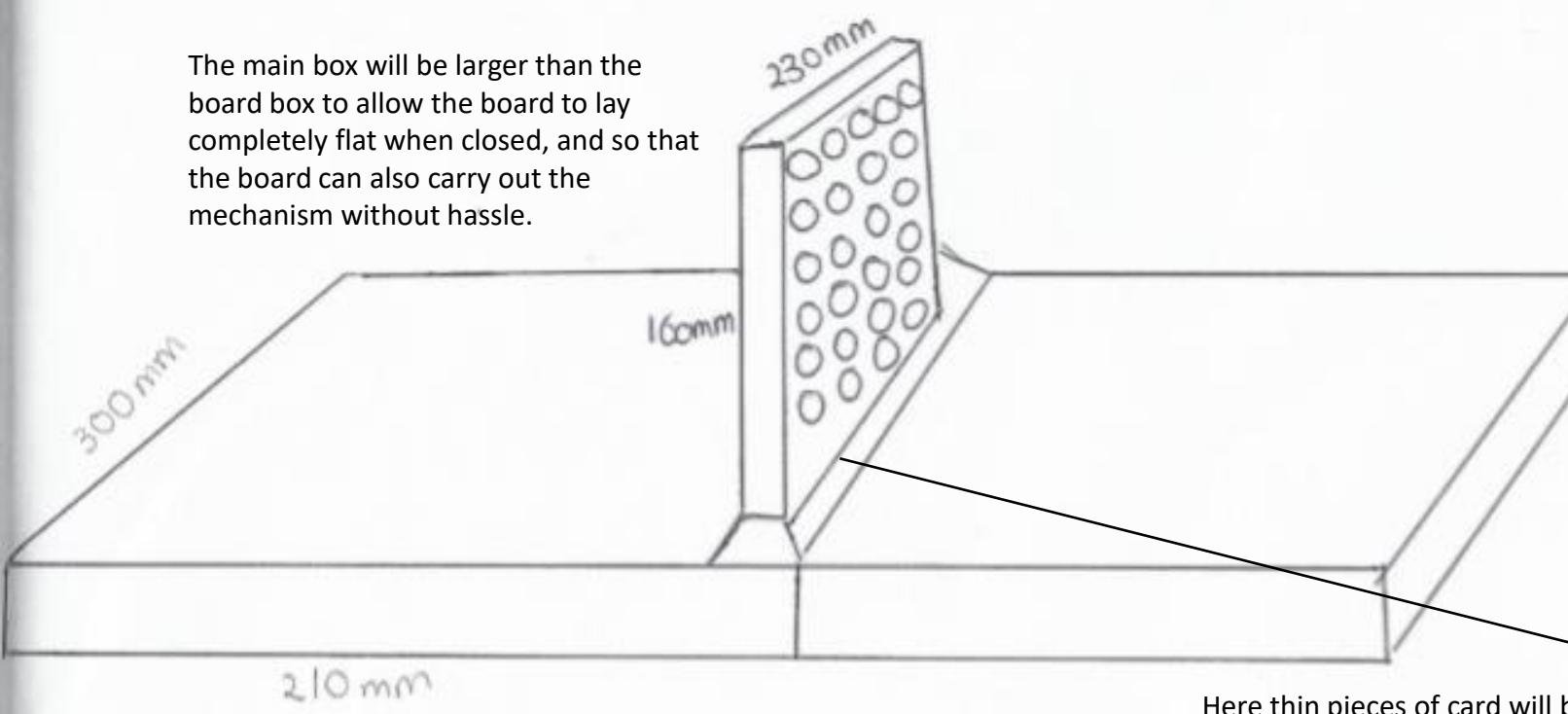
1. The product size needs to be bigger
2. Development of board mechanism to allow it to stand up tall and lay flat.
3. Efficient structure of the box that allows it to carry out it function while maintaining it aesthetic.

# Development of design ideas into chosen design-further developments

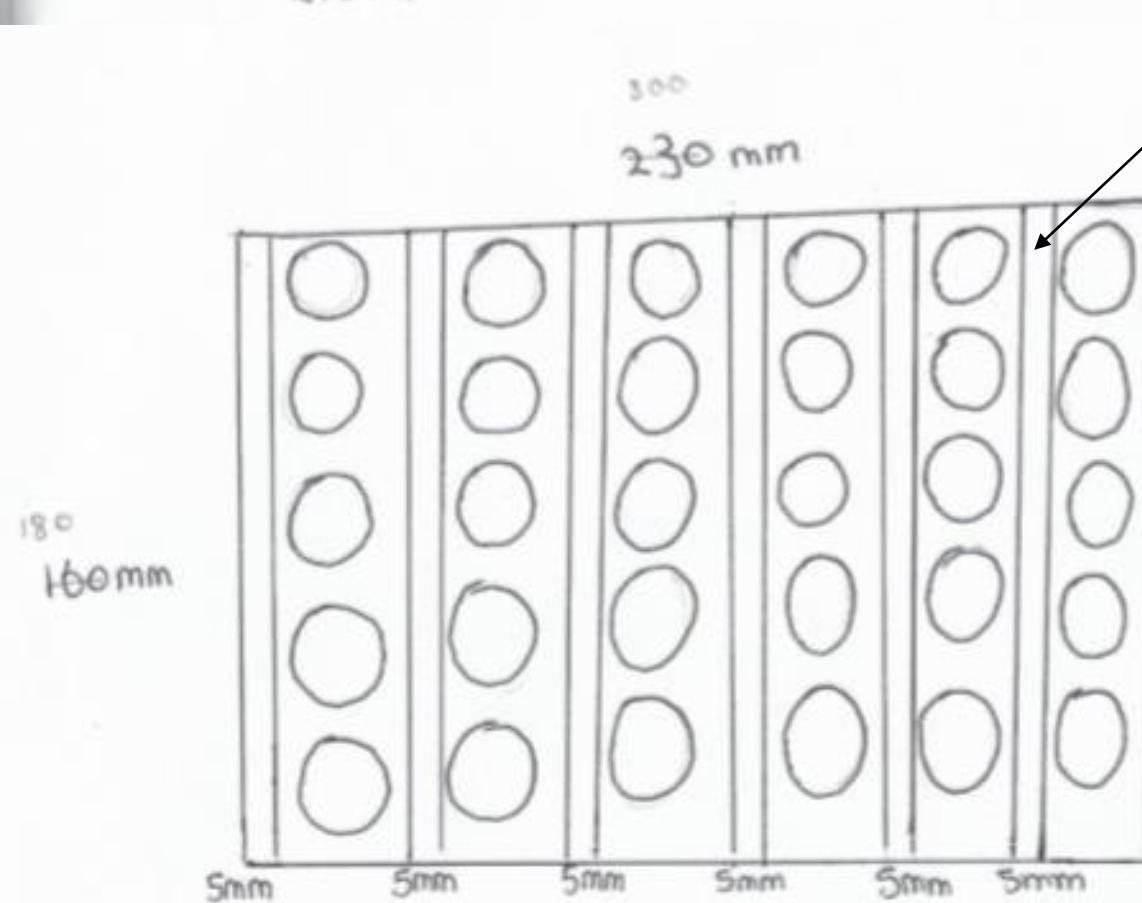
The following sketches are very brief, but they will outline how the developments will take place in the product.

On this page I will perform annotated sketches while keeping in mind the developments that need to be made to the product

The main box will be larger than the board box to allow the board to lay completely flat when closed, and so that the board can also carry out the mechanism without hassle.

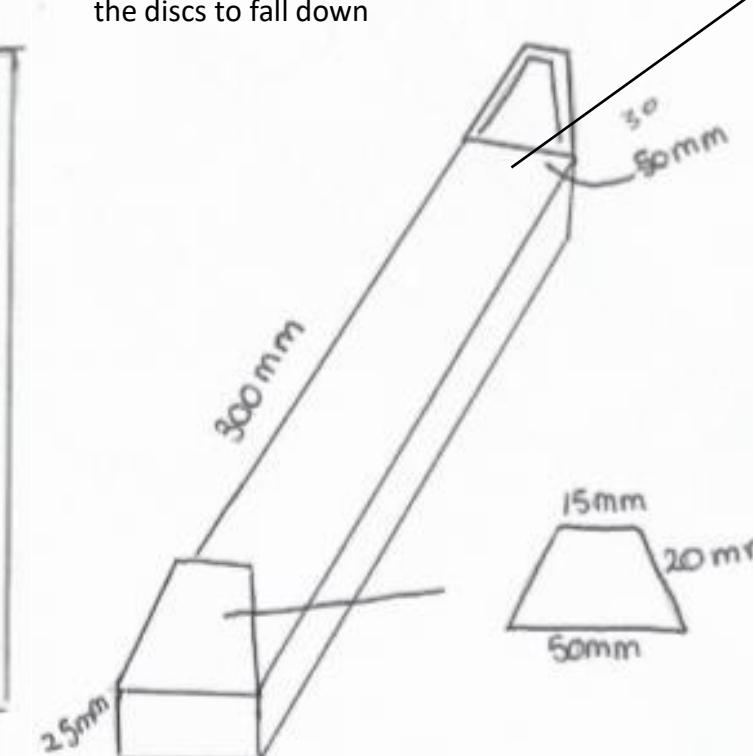


The diameter of the circles for the '4 in a row' game will need to be 30 so that enough rows and columns can fit into the board and allow the game to be played properly.

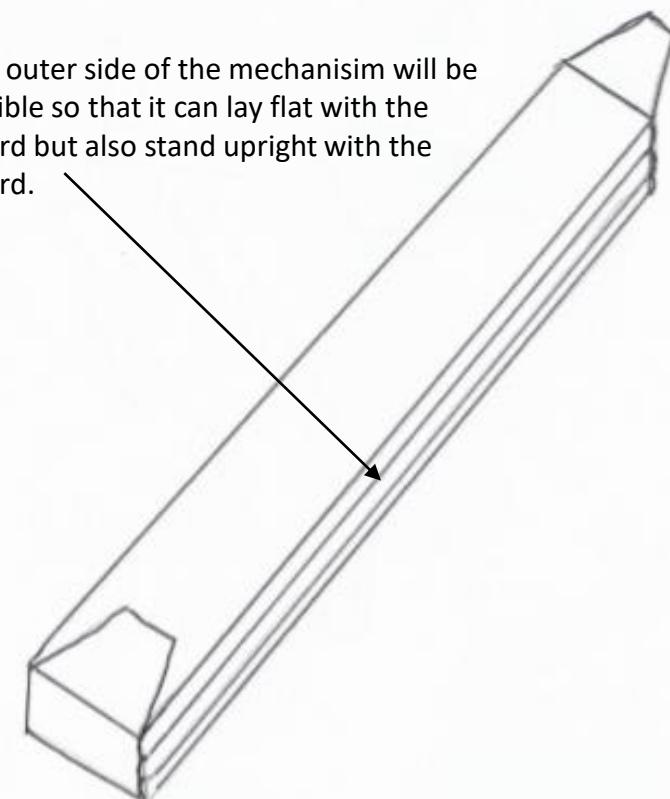


Here thin pieces of card will be placed, and then the other side of the board will be stuck to these cards, and this will allow the board to have space to allow the discs to fall down

This is the mechanism for the board, it will lay inside the board and its position will be permanent.



The outer side of the mechanism will be flexible so that it can lay flat with the board but also stand upright with the board.



# Development of design ideas into chosen design:

I will be using cardboard as it will be easier to model with and is also easier to present with and will help keeps my product sturdy.

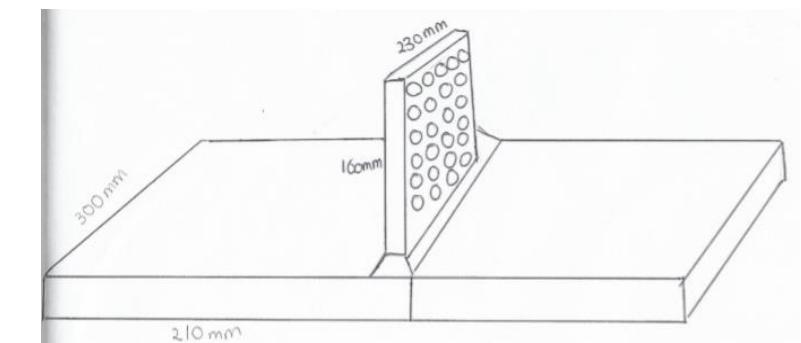
On this page and the next few pages I will be modeling my product with cardboard. with the developments that need to be made to the product, this will help me finalize my product and also identify further faults that can be improved before manufacturing.

1



I first started off by cutting out the exact measurements of the box that was identified in the further developments.

2



I then stuck the pieces together. The measurements seemed ideal for the product. After sticking the pieces together I also formed the handle of the product, I did this by cutting out a piece of card, and with that piece I half cut 8 diagonal lines , I formed cuts in the cardboard so that it can form this flexible shape rather than it being completely cut.

# Development of design ideas into chosen design:

On this page I will be continuing to model my product with the developments that need to be made to the product.

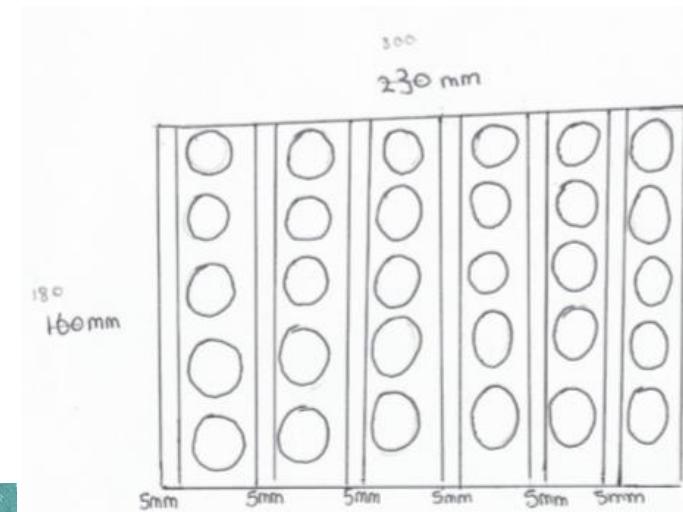
3



I then started to model the board, the first defect encountered was that the measurements I decided on for the board weren't suitable as the board didn't fit properly in the box, so adjustments needed to be made.



So the next development was the the board size needed to be edited, instead of (300mm L, 180mm H) it would be (290mm L and 180mm H).this measurement allowed it to easily fit and move in the box without hassle.



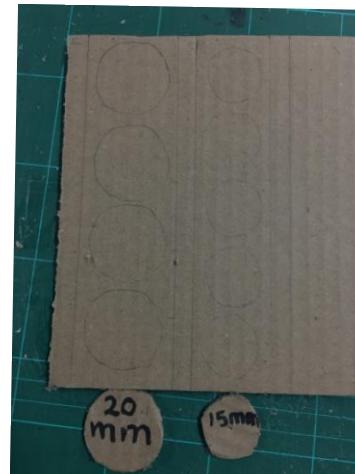
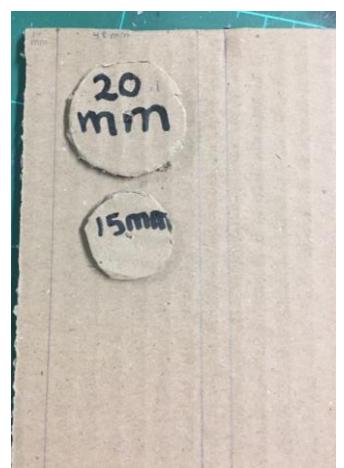
4



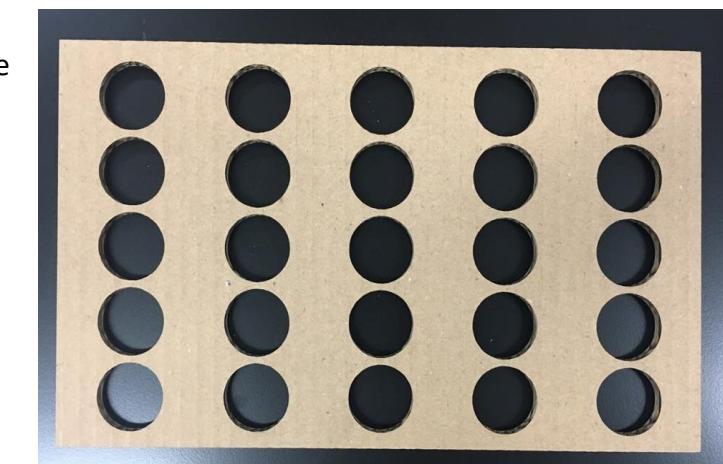
I then began to plan out the game board. I planned out the 10mm spaces that were to separate each disc from another, I also gave each column a 48mm gap for the holes.



I then needed to decide on the space between each hole, so I cut out a 15mm radius circle and a 20mm radius circle



I decided to go with 15mm as that will be more efficient space wise.



And with those measurements that were decided, I got the board lasered so that the circles were neater and more accurate.

# Development of design ideas into chosen design:

On this page I will be continuing to model my developed product.

5



I then formed the board by gluing together (300mm L and 25mm W) pieces of card and stuck them to the board, these measurements were suitable for the board as it didn't leave the board bulk looking.

The top of the board will be openable to allow the discs to fall out.

6



The idea of having the playing discs fall straight out of the board seemed reckless and hypocritical as my main task was to produce a product that helps make the playground more organized.

So I decided on making an organizing board that can be inserted inside the main board, and when the kids finish playing, they can slide the board out and readjust the discs to their places, the board will also have an extent to which it can be pulled, so that the board isn't misplaced.

7



To make the 'organizing board' easier to pull out and control, I added a thin piece of cardboard that acts like a chain, this also folds flat when closed making it fit the criteria more suitably.

# Development of design ideas into chosen design: mechanisms

Now that I have completed the bases of the product, I need to start trying out mechanisms for the board and deciding which is more suitable for the job

8



The first mechanism I focused on was the mechanism of the side of the box, and how the board was to slide into the box.

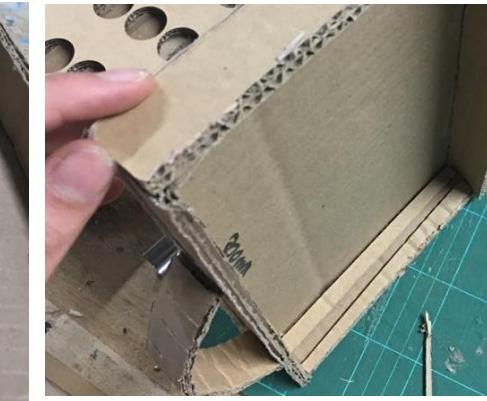
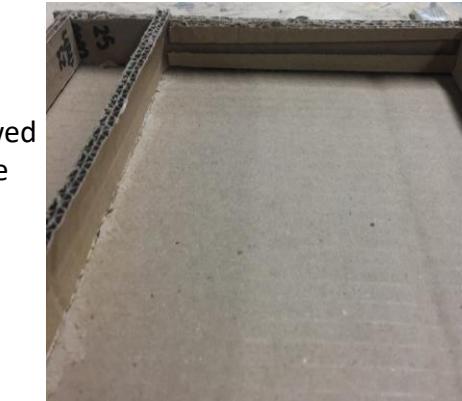
My main idea is that the sides of the boards will be routed so that there's a thin track ingrained into it which will allow the board to run through it, as for the board it could either be routed so that a thin piece of wood sticks out, and that piece will be what runs in the track, the mechanism and the piece of wood sticking out will be thin to avoid any bulkiness of the product.

To test out the mechanism, I used an extra piece of card, which will act as the side of the box, and then measured out 22mm from each side of the card and then stuck down pieces of card that fit those measurement's, leaving 5mm gap in the middle which acts as the ingrained track. As for the board, I measured 2mm on each side, and the gap produced in the middle I added a 5mm piece of card which will act as the ingrained wood.

9



The mechanism seemed to work perfectly, and the 'routed' card allowed the box to lay flat when joined to the side.



Since the mechanism worked perfectly, I inserted the mechanism to each side of the box.

10



Now that I have established the mechanism of the box. I now need to establish a mechanism that will allow the board to stand up right but also lay completely flat when closed.

My main idea was that I would use a thin flexible material that can bend easily without breaking (as demonstrated in the model).



The first problem I have encountered in the mechanism section is that the because of the extra piece of card added to the board, while laying the board flat, it causes bulkiness and so it doesn't allow the board to lay properly flat, so the first development that will need to be made is that the **box will need to be deeper** to allow the board and board mechanism to lay flat without bulkiness.

# Development of design ideas into chosen design: mechanisms

Now that I have established mechanism for the inside of the box, I need to now establish mechanisms for the outer side of the box, and ways in which the board can move from one side of the box to another.

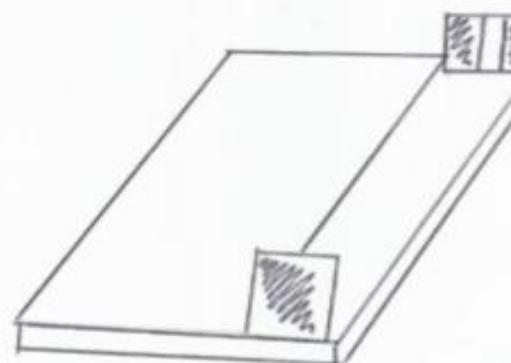
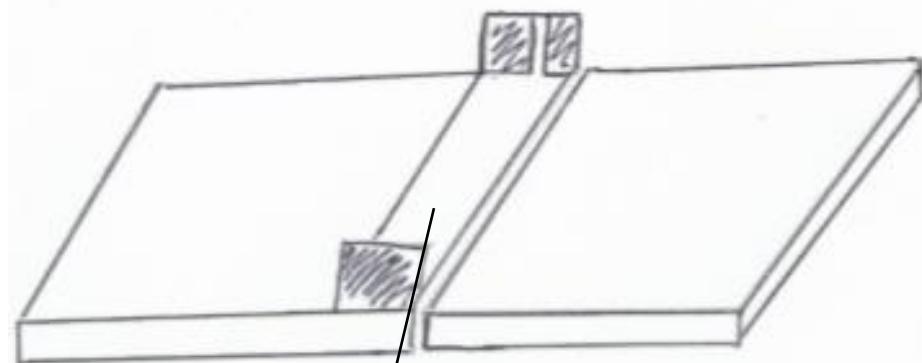
11



The first obvious outer mechanism is how the box was going to be connected, I decided to use hinges as they were reliable in making sure the box was to be kept together so that I don't risk the box falling apart while the children play with it, or if it encounters any vigorous activity from the children for example, if it falls out of children's hands, there wouldn't be any outer pieces sticking out that have the possibility of going loose or breaking.

I now needed to establish a mechanism that will allow the board to move around the box, firstly I will be focusing on how the box will move up and down, this was my initial idea for this mechanism.

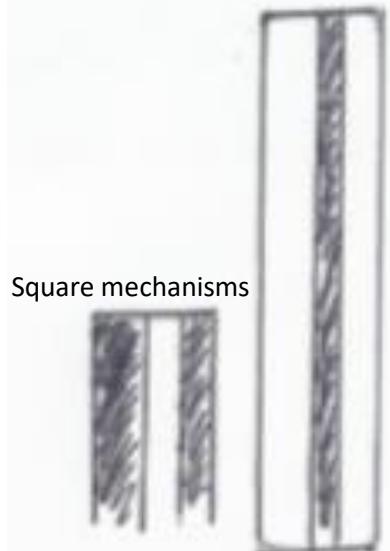
12



Side of the board



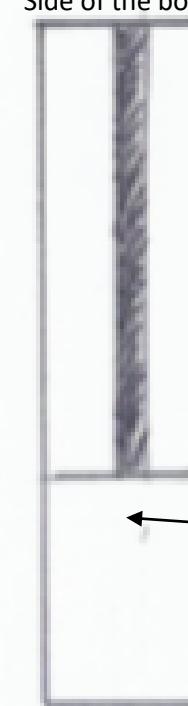
Sides of the board



This is how the mechanism will work, the sides of the board will be routed so that there is a thin piece sticking out, and the square mechanism will be routed so that there is a thin ingrain space in the middle, and together they will fit into each other like a puzzle, and allow movement of the board up and down

The idea was that there was to be a rectangle slot of wood that would run down the width of the box, which would also be the board resting stand, in the rectangle there would be two small squares of wood (cardboard for now) that would be stuck to the sides, these would allow the box to move up and down, and it will also be working besides other mechanisms to come.

This is what the mechanism between the board and the box will end up looking like



Square mechanism

# Development of design ideas into chosen design: mechanisms

Here I will be demonstrating the mechanism the board moving up and down.

13

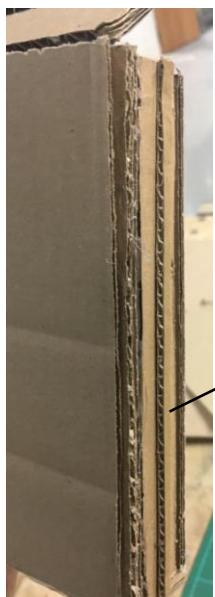


I first took a piece of card that fit the measurements of the triangle in the box and measured out two lines down the middle of the card.



I then stuck two pieces of card that fit those measurements.

This is meant to act as the routed ingrained square mechanism which will be placed inside the rectangle.



I then cut out a thin piece of card that I stuck down the middle of the side of the board, this acts as the ingrained side of the box.

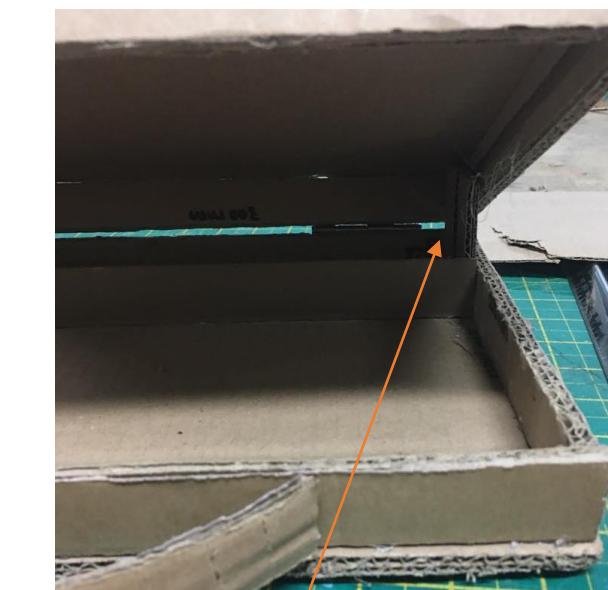


I then tried out the mechanism and it seemed to work perfectly so I stuck it down inside the triangle.



However, a problem I faced while doing this mechanism was the measurements I used for the square mechanism, the square was too small and so I would not allow the board to travel up enough to move around. So I had to develop it and make the measurements a few mm bigger to allow movement

I repeated the same steps again but with larger measurements



I encountered another problem to do with the mechanism, the box now wouldn't fully close properly since there was an extra piece of card sticking out, so further developments would need to be made, and the box will need to be deeper.

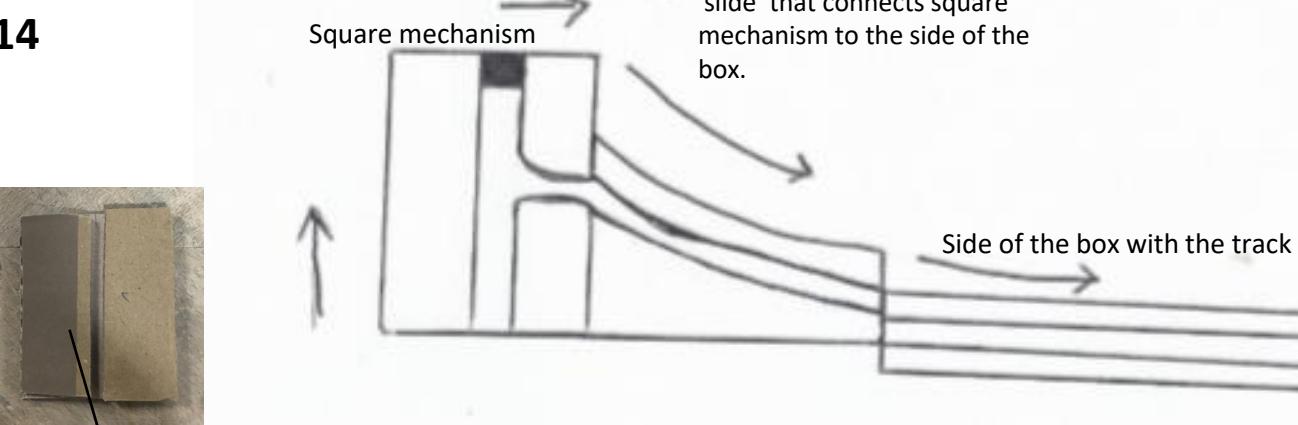
# Development of design ideas into chosen design: mechanisms

I now need to find the main mechanism that will allow the board to move around the box.

The initial idea for this mechanism is on the sketches that follow. This mechanism will be working along the other 2 mechanism to allow overall movement of the board.

This mechanism will join all other mechanisms established in the past slide to finalize the movement of the board.

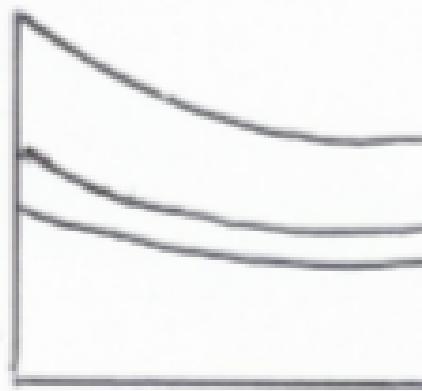
14



The square mechanism that was talked about in the past slide will be edited to fit the overall mechanism.

A slope will also be added to the mechanism to allow the board to move from one mechanism to another.

Firstly, at the top of the mechanism, there will be a small piece of wood (card in this case) that will stop the board from moving even higher than the extent that it is supposed to, this will make it more suitable to children so that the board doesn't go loose from the box and so that there's a specific way that it moves, instead of having children move it away from the box and having it end up misplaced.



The main aim of this mechanism is to allow the board to run down the 'track' easily.

The mechanism established in the past slide will be joined with the mechanisms that will be established on this page.

This part of the mechanism is the slope that will allow the board to move from its standing position into laying down inside the box, It will be connected to both mechanisms and act as a catalyst for the movement of the board.



This sketch demonstrates the side of the box with the track. This is the final part of the mechanism where the board will rest and allow the children to play with it while it lays flat.

The final part to this mechanism to allow the board to move easily, is that I will be adding a small dowel to the side of the board, the dowel will them move through the track more easily and smoothly.



# Development of design ideas into chosen design: mechanisms

With a clear image on how the mechanism is going to work I now need to model it to ensure that it works with the model.

15



I then stuck the two mechanisms together.



I repeated the same stages in making the mechanism like I did for the square mechanism, but instead of it being a square i made it as a slope.



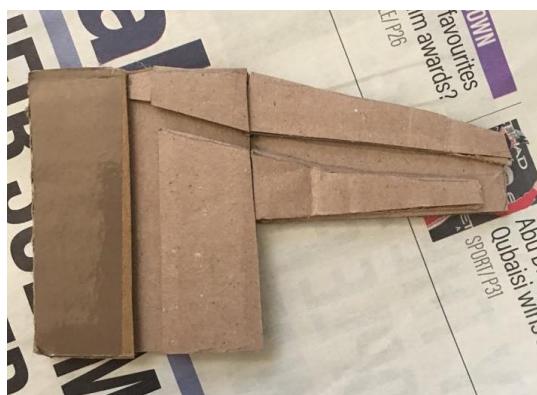
I then also cut out the 'slope' in the square mechanism and inserted a piece of card at the top which acts as the barrier for movement.



However, when I came to placing the mechanism inside the box, I realized that the way I stuck the mechanisms together **wouldn't work because of the height** difference, so to fix this problem, the slope in the square mechanism will need to be higher, and the cut in the actual slope will need to be lower



I then marked out the measurements that needed to be made.



So I repeated the process once more with the new measurements. And since the mechanisms now looked more ideal, I tried it out with a dowel, since a dowel will be stuck to the side of the board as part of the mechanism.

## Development of design ideas into chosen design: mechanisms

The last mechanism I need to establish is how the board will turn so it can switch what side the game is.

The main idea was to insert a dowel in the side of the board so that it can move up and down with the help of the mechanism .



I cut out a small, long piece of card and a small piece from a dowel.



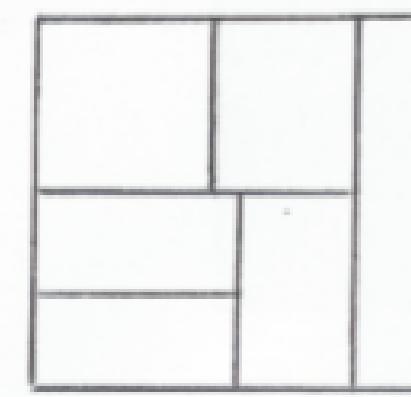
I stuck the piece of card besides the other piece of card that was already there from the past mechanisms, together they will act as the track for the dowel, so they would be routed making them stick slightly out of the side, and due to the route there will be an ingrained track which the dowel will run through easily.



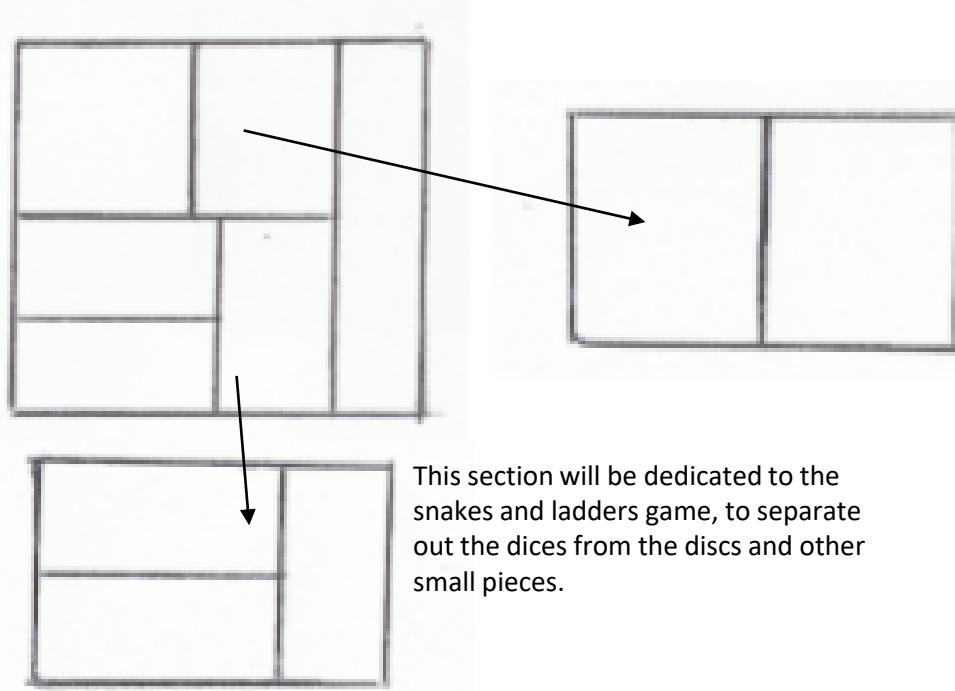
This is an example of what the dowel track would look like in action.

# Development of design ideas into chosen design: organization

Now that I have established all the mechanisms for the board and box, I need to find a way to organize the box to place the smaller pieces of the game, since the main problem I am trying to solve is organization in a playground, so I need to find a way to maintain organization within my product.



The sketch represents this side of the box.

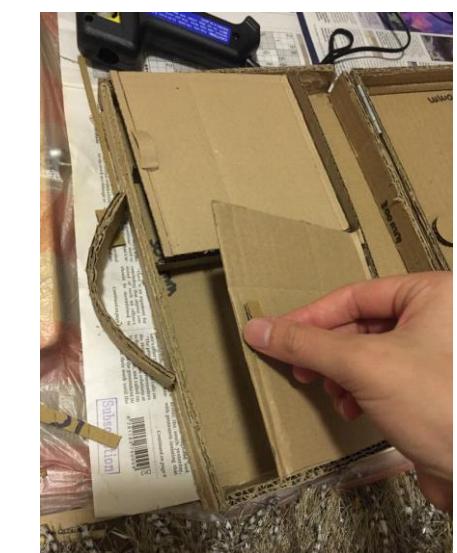


This section will be dedicated to the snakes and ladders game, to separate out the dices from the discs and other small pieces.

This section is dedicated to the 'connect4' game as it will separate out the two different colored discs.

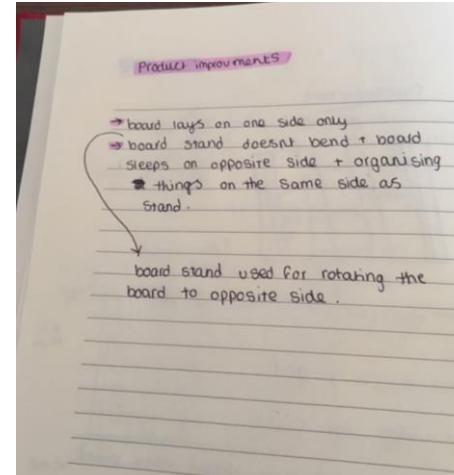
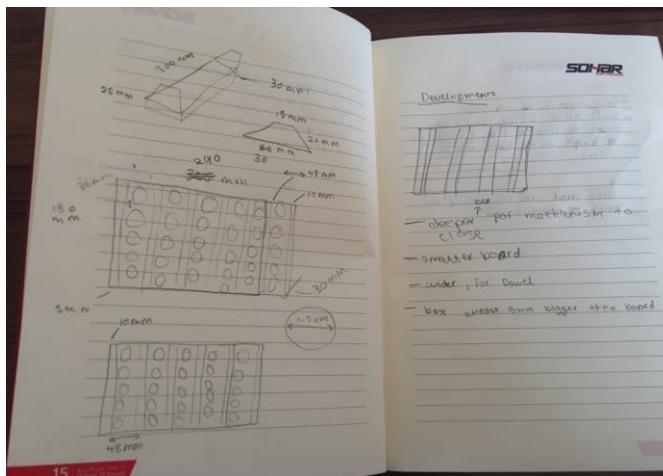


I have also decided that another way to maintain organization is to place an acrylic lid over the organizing slots, they will be magnetically connected to ensure that it doesn't go loose, and it will also ensure that the small pieces stay in their position.



This is an example of what the lids will look like, however they will be see through and made out of acrylic to add a nicer look to the box.

# Product development and mistakes.



Throughout the modelling stages I took notes of what needs to be improved in the product and of those included things as (size, and how the product works as a whole).

On this page I will be identifying mistakes and further developments that I have established throughout modeling my product, and ways that the product can be developed further to increase efficiency.



## Measurement development:

1. The box needs to be deeper so that the square mechanism can close within the box.
2. The board should be smaller/ the box needs to be bigger, so that the board lays comfortable and to avoid bulkiness.
3. The box needs to be wider so the dowel and mechanisms can work without the box breaking.
4. Box should be at least 5mm bigger than the board.

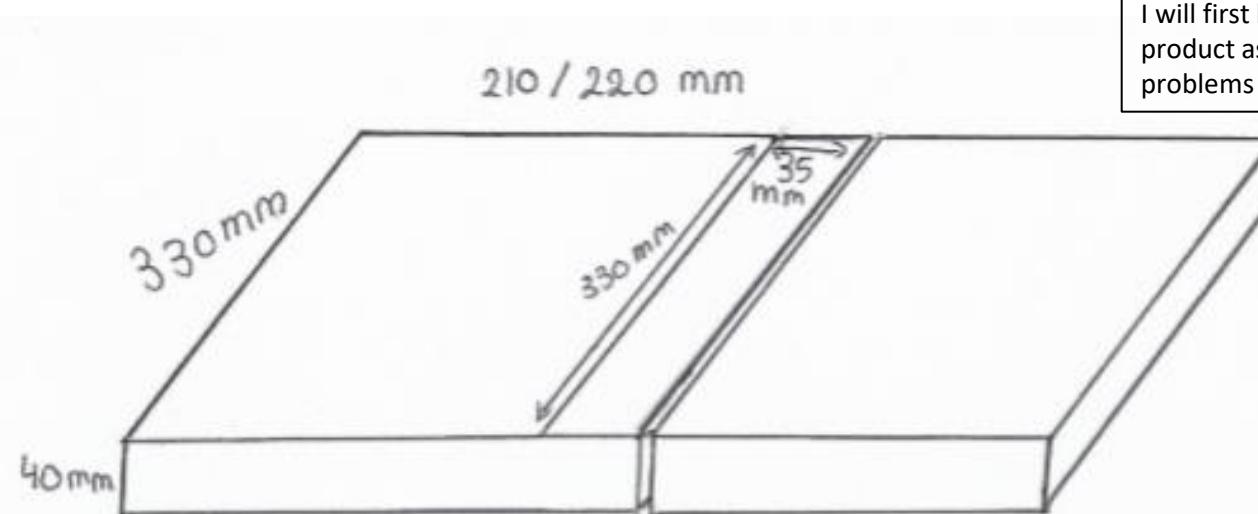
## Overall product improvement:

1. Board will lay on one side only (the opposite side of the mechanism)
2. The board stand will not bend, since the board will lay on the other side.
3. The board stand will be used to rotate the board to the opposite side.
4. On the back of the box there will be information cards explaining how the product works to avoid confusion.

Throughout modelling my product I have found ways that the product can be developed in order to make the product more efficient, and these developments made more sense for the purpose of the product.

- 1) The board will lay on the lay on the opposite side of the mechanism, as the side that contains the mechanism also contains the organizing boxes so there will be no room for the box to lay, but the box will need to go back to the stand so the it can rotate sides.

Despite planning that the board was going to be smaller than the box, due to the bulkiness off the whole board it would not fit properly inside the box and so caused the box to break, so the main development would be to edit the sizes of the board and box.



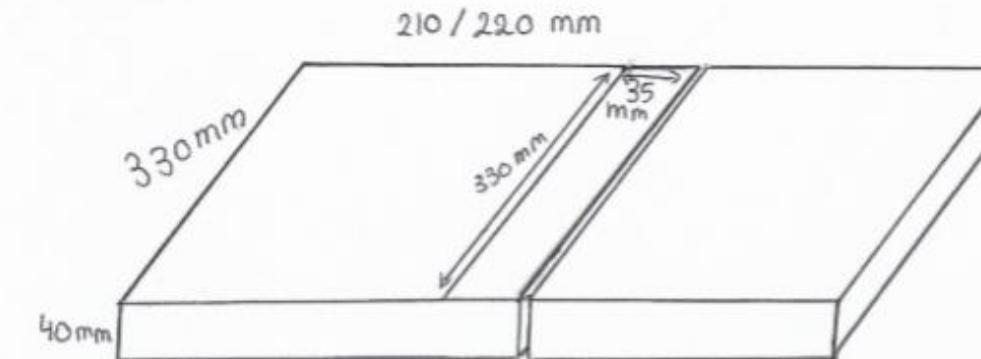
I will first be focusing on the base of the product as that is what caused most problems

Taking in the areas that need to be developed, I have established new measurements for the product, and on the next few pages I will be re-modelling the product again with card and the new measurements and testing out the difference between both models.

# Product development and mistakes.

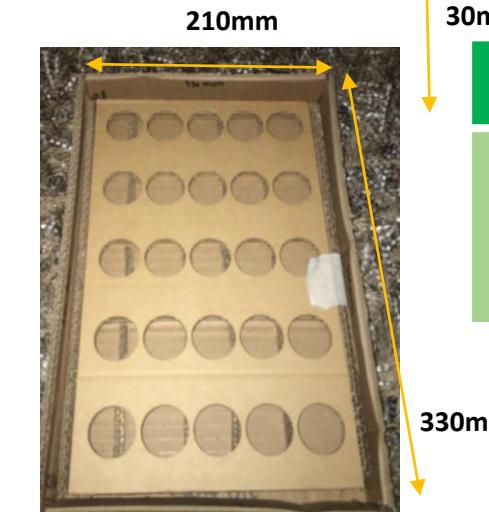
Before modelling my whole product, I will first need to decide on the measurements of the bases, as in the past slide I established that the box needs to be bigger and wider(+higher).

I couldn't decide on what measurements to use so I modelled all three measurements that were the outcome of what needs to be improved.



For the first trial I used the measurements (210mm W, 330mm length, 30mm depth/height)

1



Height of the box

210mm

30mm

## Pros of using these measurement's:

- The board fits comfortably inside the box
- Box is **wider**, so the board isn't forced into the box.

## Cons of using these measurement's:

- The board is just about the height of the box' side, so when closing the box, the mechanism will not allow it to close properly due to the box not being deep enough to allow the mechanisms to stick inside them without bending.

Because these Measurement's weren't ideal for the box, I then tried a different measurement that would hopefully fit the necessities for the box better.



Height/depth of the box

230mm

40mm

## Pros of using these measurements

- There's a lot of space for the box to lay .
- The **height** of the box is perfect, it allows there to be a space difference between the board and box so the mechanisms can them slide into the sides when closing.

## Cons of using these measurements

- The box is too big.
- The measurements will cause the box to be too bulky.

From the first trial I established that the length of the box was good, but the width and depth needed to be edited allow the mechanism of the board to work easier.

So the next measurements I used were (230mm W, 330mm L, 40mm H/depth)



40mm

210mm

330mm

## Pros of the measurements:

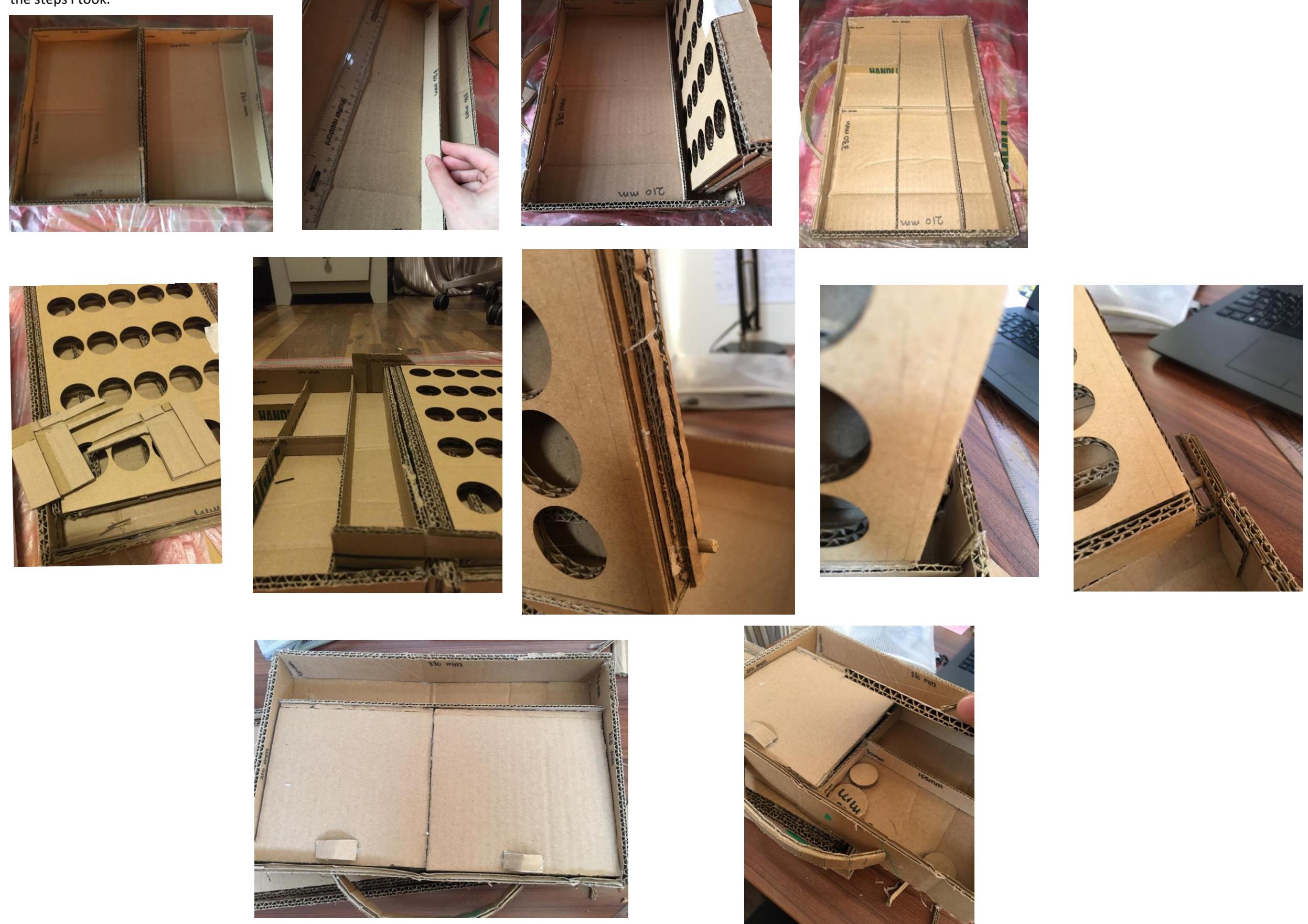
- The height is perfect for the box, allows space for the mechanism to be stored.
- The length and width are ideal, allowing a good deal of space for the board to lay and not have to be forced inside the box.

With the improvements that need to be made to the product I will be re-modelling it all over again using the same steps as before but with different measurements to see whether these improvements made a difference to the product or not.

# Product development and mistakes.

I will be modelling the product the same exact way I did before, so I will not include the steps I took.

Now that I have confirmed and tried out the measurements for the improved model of the product, I will be remodeling it all the same way I did before including the mechanism and analyzing the finished product.



# Mechanism problems

While I was modelling my product for the final time with the confirmed measurements and mechanisms, I was overcome with yet another problem that related to the mechanism.

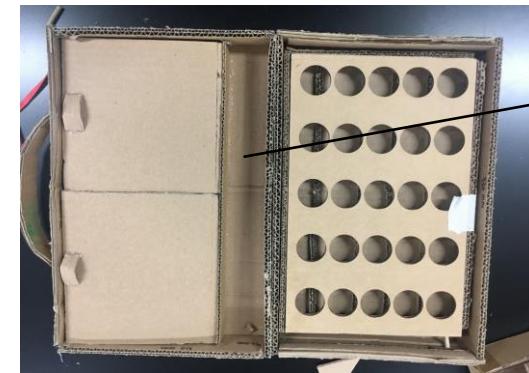
Because the mechanism of the moving board was bulky it didn't allow the box to close properly that would cause the mechanism to stick out of the box, so I now need to find solutions to this problem.



This mechanism was bulky and because it **isn't flexible it would stick out** of the box when it is closed. So this mechanism needs to be edited to solve this problem.

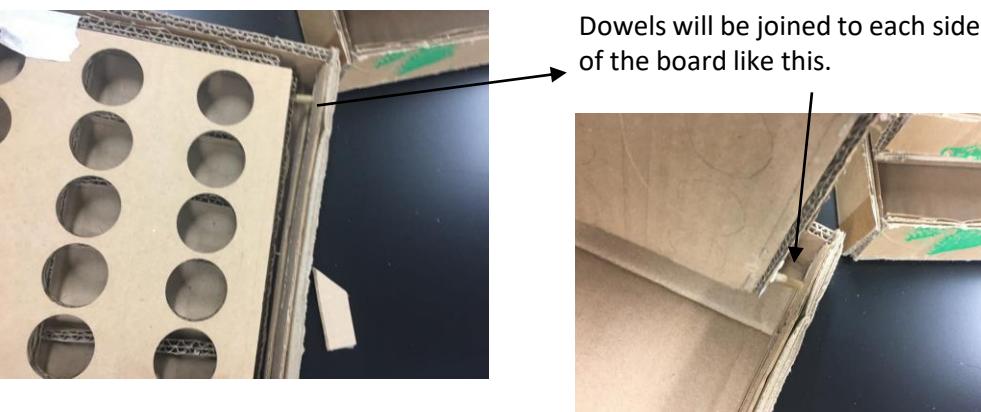
The solution to this problem is to completely remove this mechanism. By doing this it means that the routed mechanism will be the only one left to enable the board to move around.

So one side will be dedicated to the moving board where two dowels will be placed into the side of the box, and these dowels can then run through the routed track. This also means that the stand for the board will no longer be needed as it will not be able to access, so because of this the opposite side of the board will be dedicated to maintain organization in the board.



This will be removed, and then the organization side will become bigger.

## Development:



Dowels will be joined to each side of the board like this.

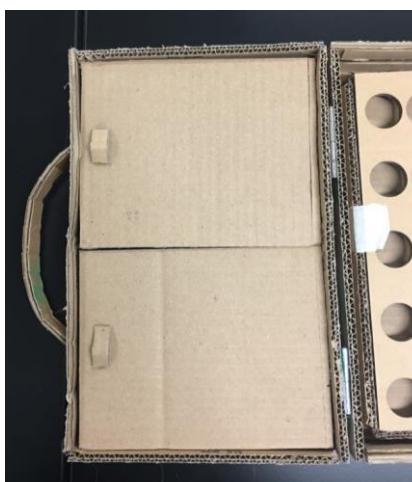
The dowels will allow the board to move the routed sides.



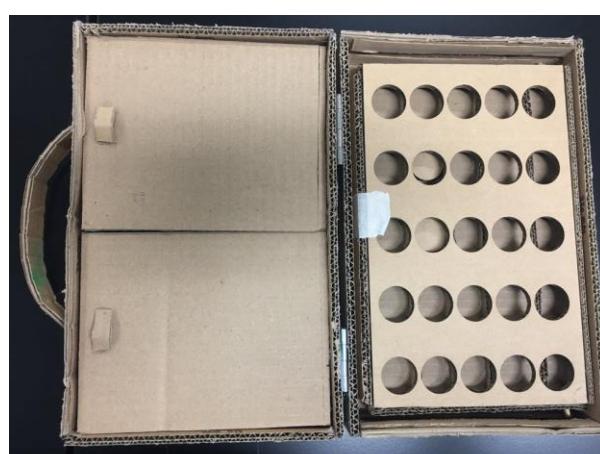
The dowels will also allow the board to rotate to either side as there will be two games, one on each side. This will work because when the dowels reach one end of the board they will lie down on either side.



The mechanism inside the board will still work effectively as the children will still be able to pull out the organizing tray from the top of the board.



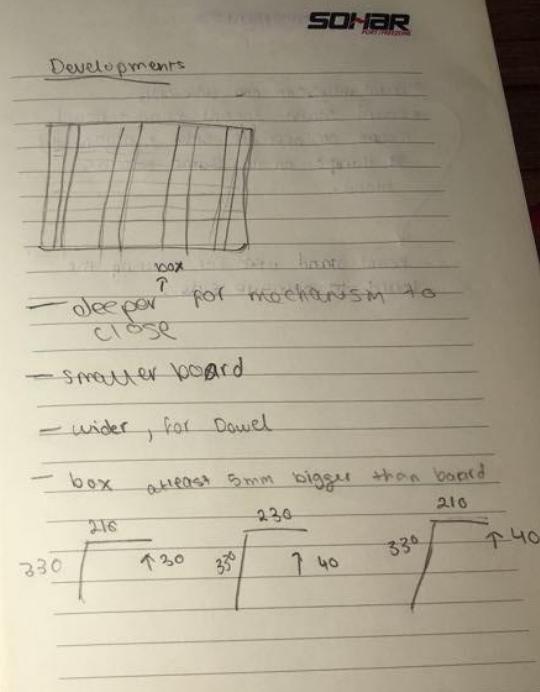
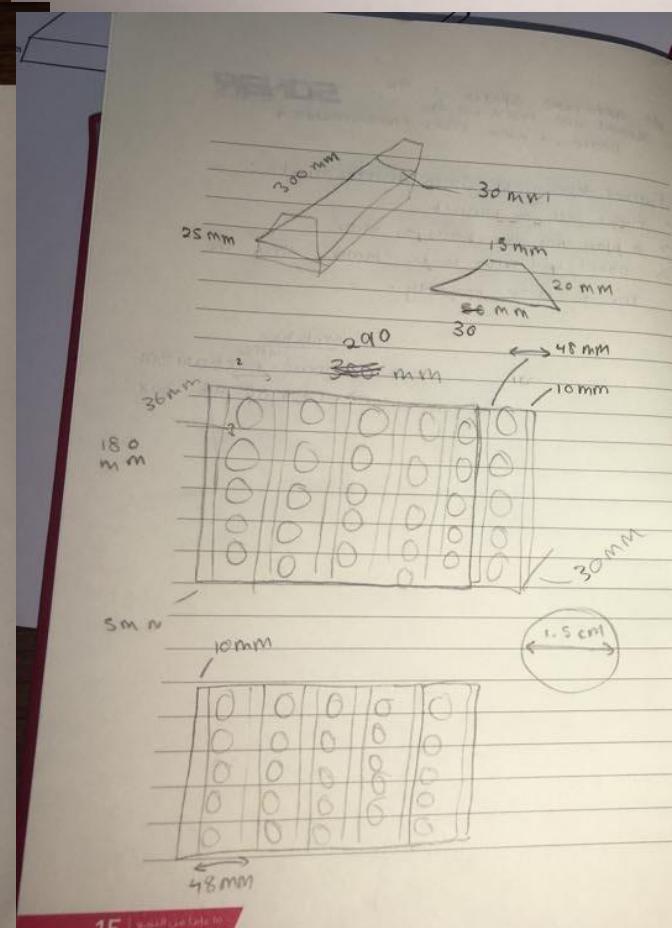
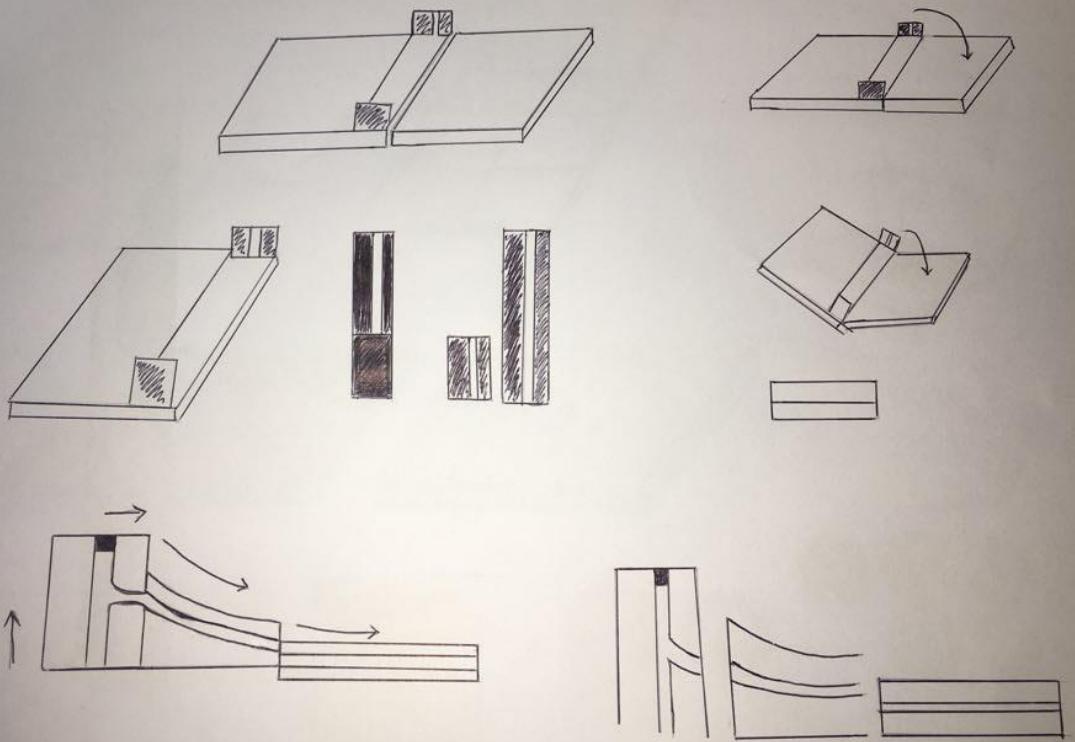
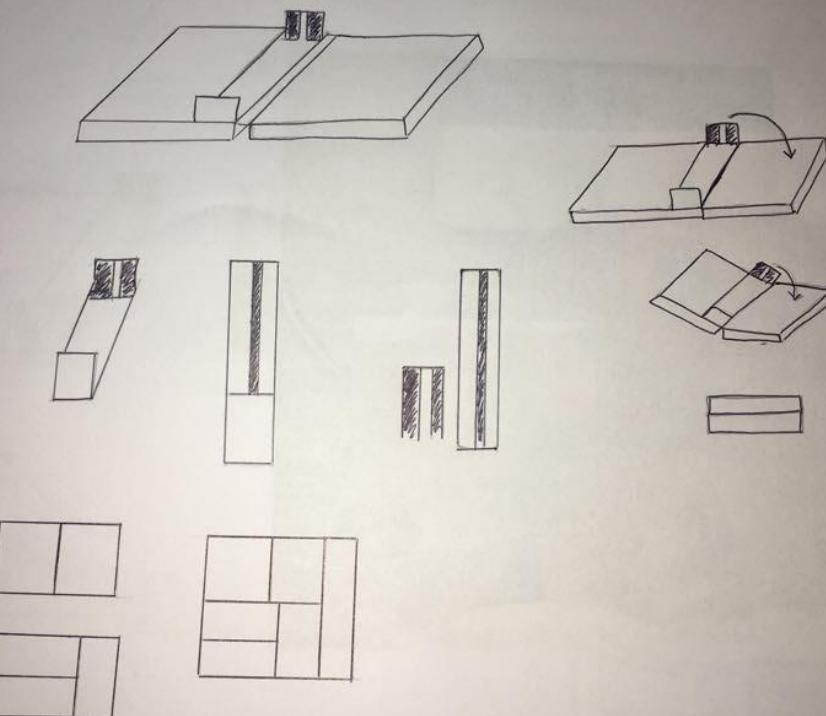
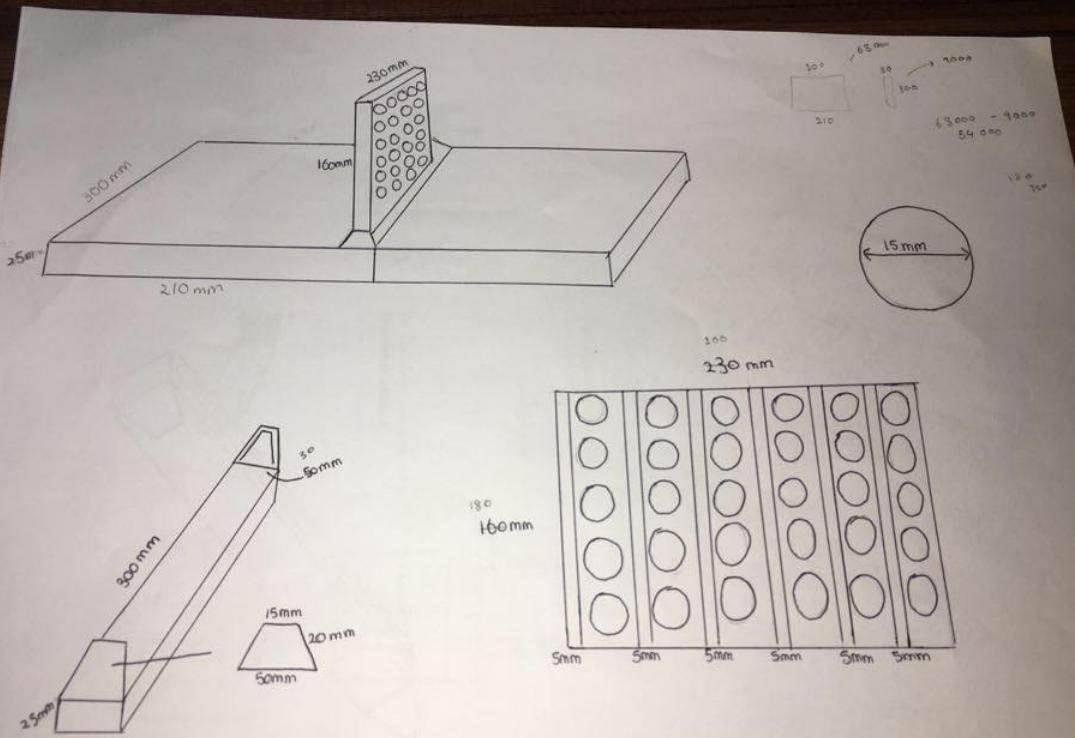
The board slot was taken out and the organizing slots were extended so that they took up the whole side of the board.



While I was modelling my product for the final time with the overcome with another problem. On this page I will be finding solutions to overcome this problem.

## Planning and sketches.

The following sketches are those I did throughout the modelling stages initialize my ideas and improvements.



# Material development:

I have already talked about materials that I was going to use for this product on page 41 but since there has been so much development, I need to finalize the materials that will be used and why.

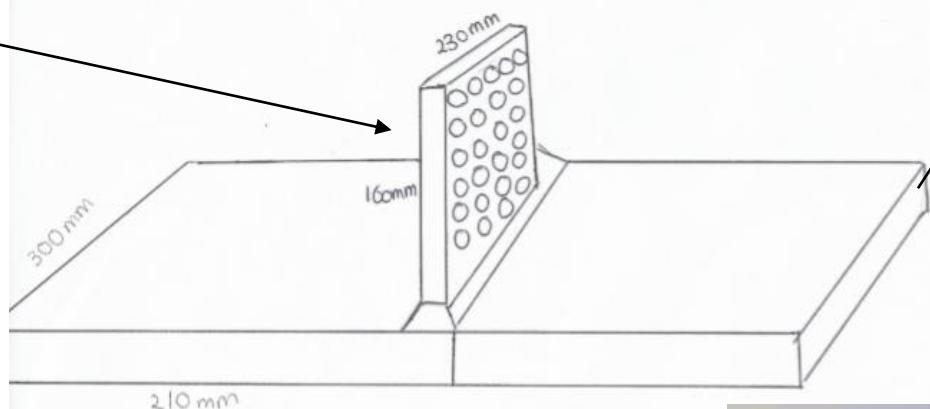
The starting material for the board was pine, however because the board already has a secure cover (the base) it doesn't need to be made of a material as strong, so I decided that the board can be made from either MDF or balsa, as they are light weight and easy to work with. The woods are also quite thin which is good as it will prevent bulkiness of the board. The aesthetic of the wood in this case doesn't matter as the board will be painted and designed according to a theme.



Veneered MDF



balsa



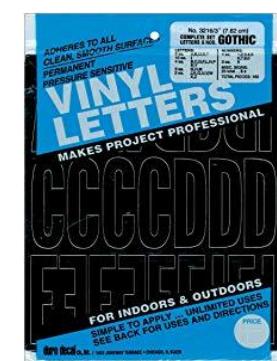
I have also claimed before that my product will have a theme (eg; animals) so the discs can be made from acrylic so that the chosen theme can be imprinted onto the discs and improve aesthetic.



This side of the box is just dedicated to organization, so to make it look nicer I can use acrylic as the lids, so they will be see through and the children will be able to see all the colorful discs and dice.



To help children maintain the organization of the box, I will also use vinyl stickers and spell out the name of each game on the top of the lid, so that children don't get confused and on where to put the small pieces. I will also use magnets at the ends of the slots so that the slots will remain closed and prevent messiness.



The main characteristic that is needed in the materials that I will be using is that they have to be strong, durable to outdoor weather and should be lightweight so that children don't struggle in carrying. It along with these characteristics my product needs to follow my product specification where I claimed that the materials I used need to be as sustainable and environmental friendly as possible, for example through investigation I have found that I should stay away from using oak as it is becoming rarer and so not the best choice for a sustainable product, the aesthetic of the wood doesn't matter as well as the box will be painted over with a design so the grain will be covered either way.

Now that I have established all the basics of the product I now need to establish what materials I will be using for the product.

Before modeling my product, I decided that the base of the product can be made from veneered balsa or MDF. However this is not a good idea as balsa is quite weak and so won't handle the pressure of the whole product, and since they are the main 'cover' for the board they need the most strength so that they can handle pressure and possible damages better.

So instead of veneered balsa I decide that the base of the product can be made from pine or beech. Some favorable characteristics of pine is that it is (very durable, easy to work, quite cheap as it grows quickly enough to be forested, and reasonably strong and lightweight.) these are very useful characteristics as the product is associated with the outdoor, so it needs to be durable to such climate.

However pine tends to wrap or splinter more often than other woods so it can be veneered to reduce chances.

Beech can also be used as it has similar characteristics and is very sustainable, cheap and strong.



Beech



pine



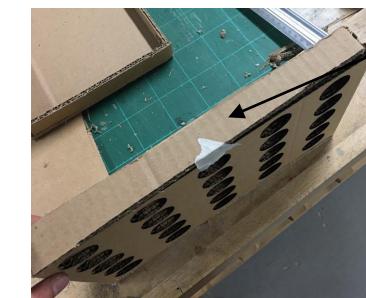
In the previous material development slides, I stated that the handle can be made from oak as it is strong, however due to sustainable reasons oak is not the best choice, so an alternative can be beech as it is strong and will be able to handle pressure that the box might face.



oak



Beech



The way that this part of the product will be connected to the board is by small hinges so that it can open and close properly, and it will shut by using magnets which will hold the product closed.



# Material development

Now that I have an idea of the materials, I need to test and evaluate the materials to see which one of the two materials suggested fits the criteria better and will carry out a more efficient job for the product.

The two materials I had decided on for the base were; beech and pine. Since the base is the frame of the product its needs the most support to make sure that the board is as safe as possibly as it will be made of a lighter and more damage prone material.

So characteristics that are needed in the wood are; it needs to be strong, to be able to handle the weight of the product, it needs to be dent free, so that if it bumps any sharp corners it doesn't dent and ruin the aesthetic of the material, and durable to outdoor conditions.

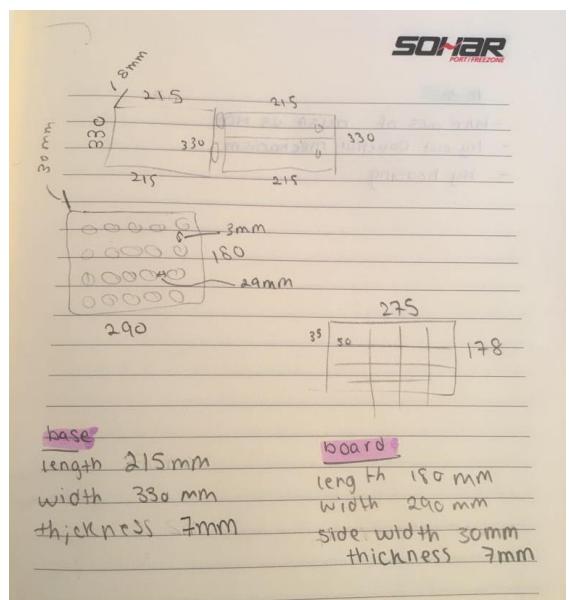
To experiment for the majority of these characteristics, I decided to take a sample plank of wood of both pine and beech and hammer them both (acts as the damage that may be encountered due to children) and with these results I would decide which wood to use.

I also repeated this experiment with MDF and balsa to decide which material was most suitable for the board of the product. The board does not need as much strength in the wood as the box itself as it is protected by the frame of the box, but it needs enough strength to be able to maintain doing its job efficiently.

## Final materials that will be used:

- MDF (board)
- Beech (frame of the box)
- Acrylic(discs)
- Hinges + nails (to connect the two sides together)
- Beech (handle)
- Acrylic (lid of the organizing board)

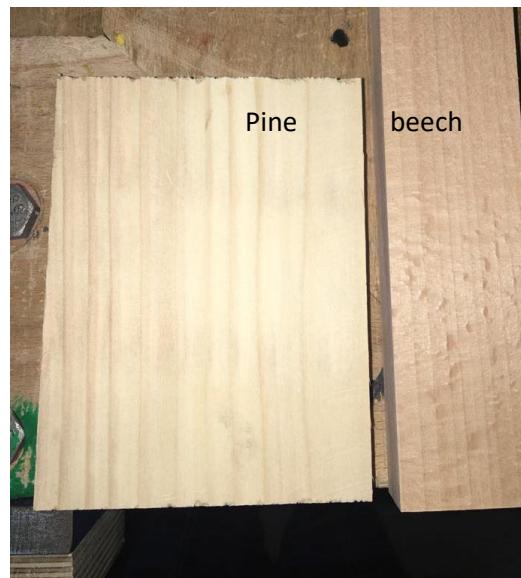
## Final measurements:



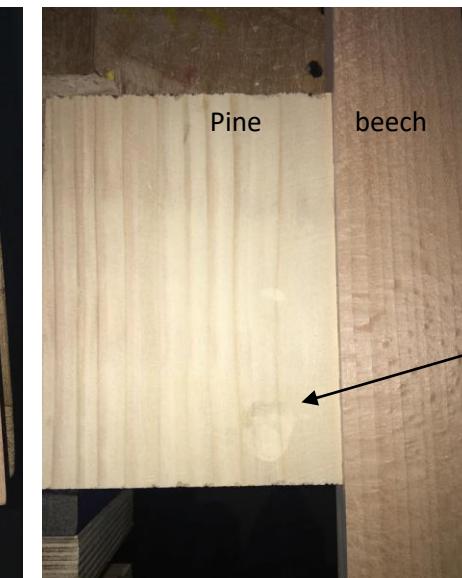
The majority of these measurements decided were previously used in modeling my product, and because they carried out their job effectively, I decided to continue through with them onto my final product.

For the thickness of the wood, I wasn't sure between 7mm or 10mm thick, so I tested out both measurements by cutting up a plank of wood to the longest measurement in my product (330mm-width) and applying pressure to the plank to see which thickness gives out first and splinters.

## Before:



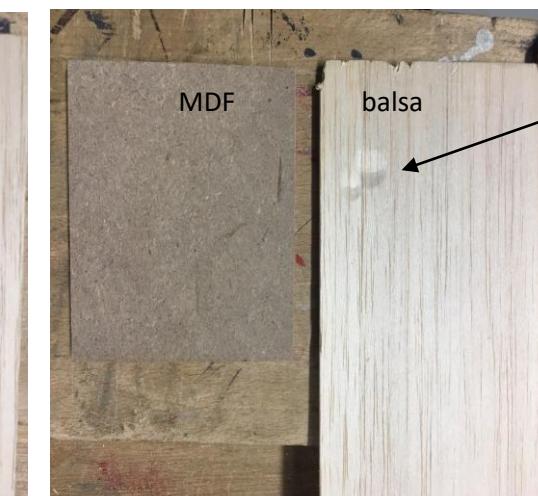
## After:



Now that i have an idea of the materials that I might use I need to test out which materials meet the characteristics and the specification more.

### Analysis:

As you can see, with a light hit by a hammer, pine easily dented whereas beech remained smooth, meaning that if I use pine for my product over time, the way that children may interact with the product may cause it to dent everywhere and even have the possibility of breaking and ruining the whole aesthetic, and for that reason the wood that will be used for the frame of the product is Beech.



### Analysis:

As you can see, with just one light hit with a hammer, balsa dented easily, I also experimented by driven my nails into the sides of the wood, while MDF maintained strong. Balsa went on to dent even more, showing how it is unsuitable for this job, and so the wood that will be used for the board will be MDF



Before moving onto manufacturing, I need to decide the final measurements and thicknesses of the woods I will be using for the product.

Measurment's continued on next page



I did this with both measurements to see which handles stress better.

Both thicknesses reacted the same and neither showed signs of stress or splitting, so I will be using the measurements of 7mm thick to maintain lightness to the product and ensuring it doesn't become bulky.

### Base (frame): measurement of planks

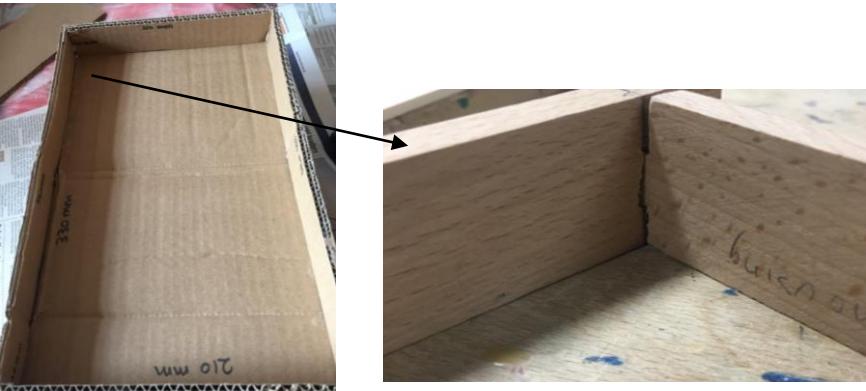
**Length:** 215mm  
**Width:** 330mm  
**Thickness:** 7mm  
**Height of planks:** 40mm

### Board: measurement of planks

**Length:** 180mm  
**Width:** 290mm  
**Side width:** 30mm  
**Thickness:** 7mm

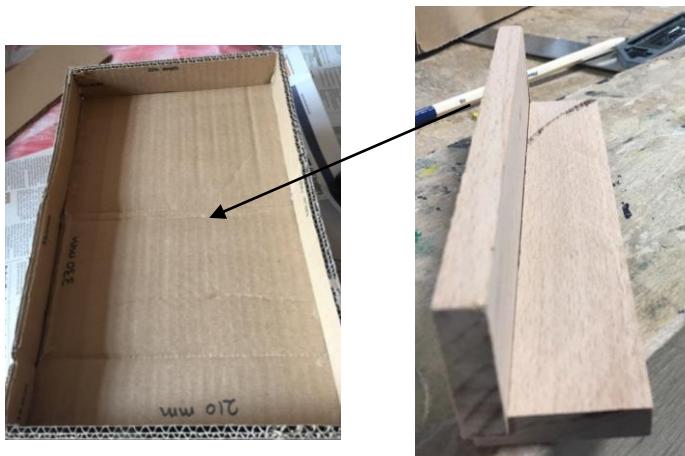
## Developing the joints:

To join the sides of the board I decided that I would join them using dovetail joints, this will ensure that their position is secure, and they won't move apart.

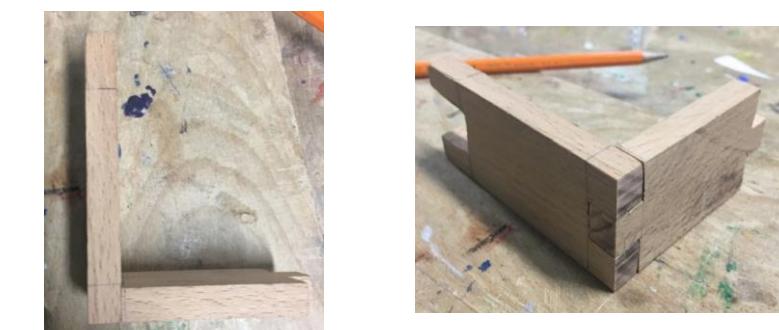


The final part of developing the board is deciding what joints will be used to join the part of the board together. I will also be testing out each joint I decide on.

To connect the sides of the board with the base decided of the rebate joint as it won't minimize the measurements decided on and again won't take up much space in the box.



Another alternative for joints for the side of the box could be finger joints, as they also ensure stability and strength.



For the slots on the organizing board, these can be joined together using housing joint, as housing joints consist of cuts in the middle of the wood where the other piece of wood lays.



These joints will also be used to connect the sides of the board together.

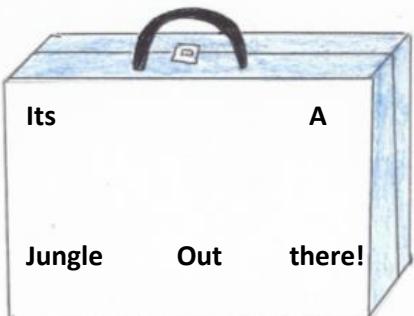
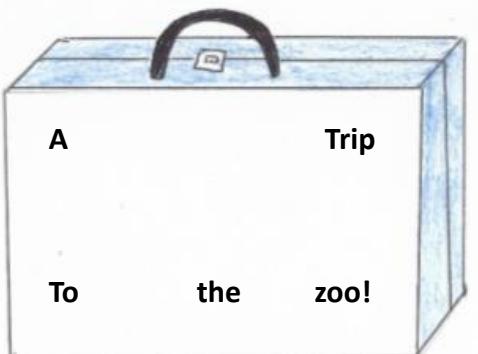
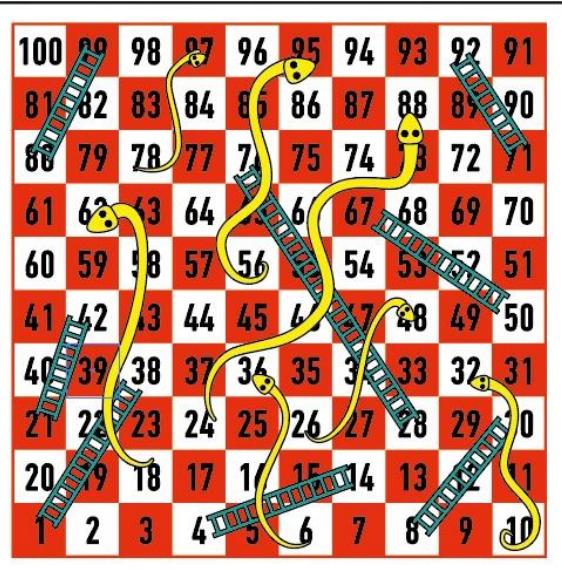
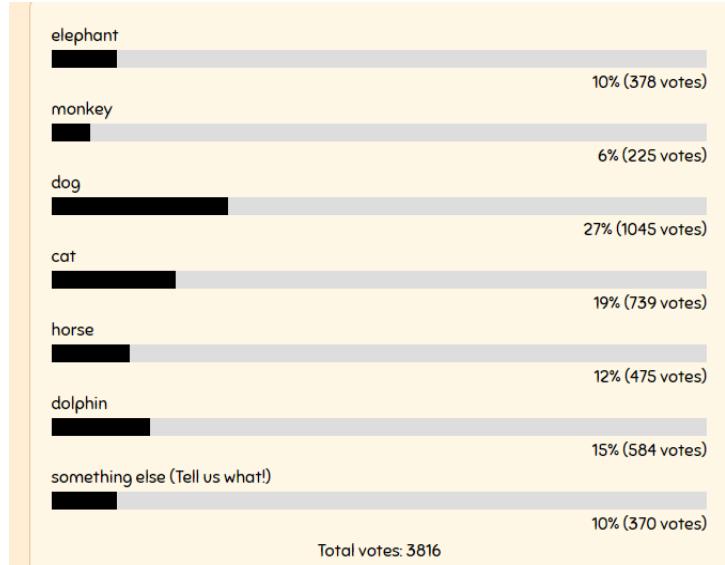
Housing joints will also be used for the organizing board that will be inside the board.

## Aesthetic of the board:

I have already kind off developed the aesthetic of the board on page 38/39. But on this page, I will be finalizing the aesthetic and how the finalize board will look like.

The main theme of the product will be animals, as animals are every child's favorite and so fits both sexes and won't be targeted towards a specific gender.

From research I have found that dogs and cats are the most favorited animals and following that it is hoses and dolphins.

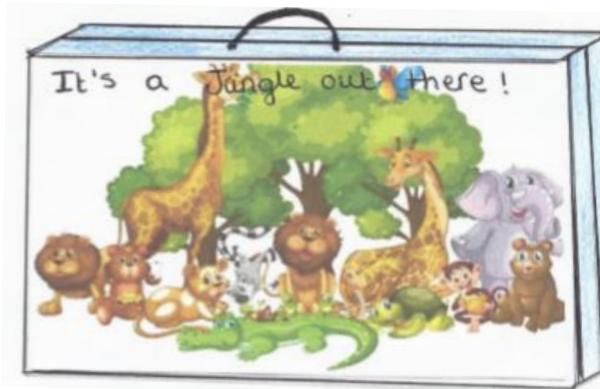
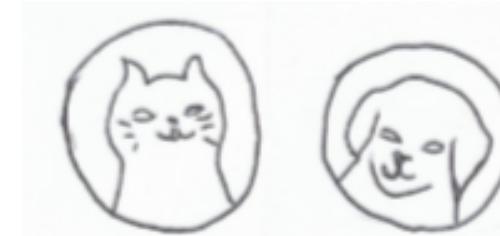


For the design of the front of the box, I will be designing an image of a zoo that can be printed in sticker and stuck onto the front of the board, above are some examples.

The snakes and ladders game will also be ingrained or stickered onto the board but instead of these colors, colors decided in the spec will be chosen, (for example, red, yellow, blue orange, green, pink and purple) this is an example of a snakes and ladders game, I will be designing my own for my product.

Sides of the box will be painted light blue as it is a unisex color and as well as being one of the most favorited colors it is also quite light, so it won't take away any aesthetic from the box

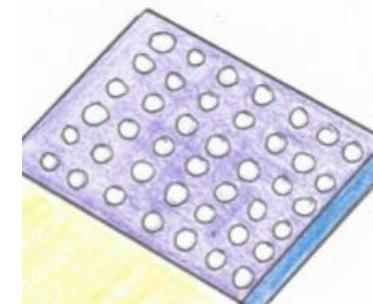
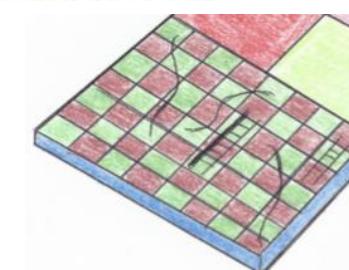
Since dogs and cats are the two most liked animals and they are polar opposites, I will be using them for the connect 4 game, and then the main aim will be who can connect 4 of their animals first.



The rest of the animals including the elephants, monkeys, dolphins, lions and foxes will be used for the opposite side of the board which is the snakes n ladders game, so these animals will be the discs for that board, and one of each will be made so that children can choose what animal they want to play with, and as 5 animals have been chosen for the snakes and ladders discs it means that at least 5 children can play with that side of the box at the same time.



To continue the theme of animals, a snake or alligator handle can be used for the box as it will increase the aesthetic and pulls the theme together



Connect 4 can be painted a really light shade of purple as it is a unisex color, and will also look good with the color of the box, and the snakes and ladders game will be painted red and green as they go well together.

# Final design:

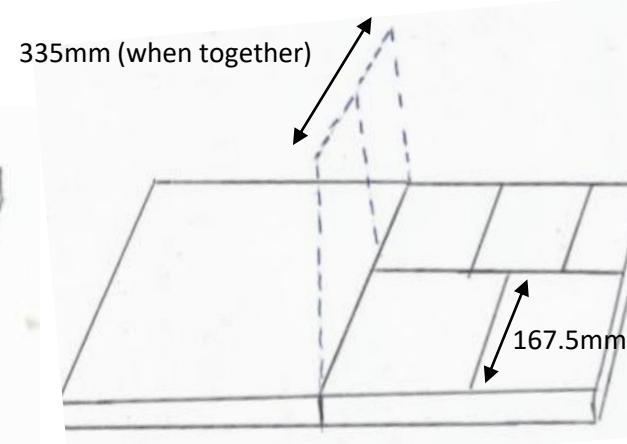
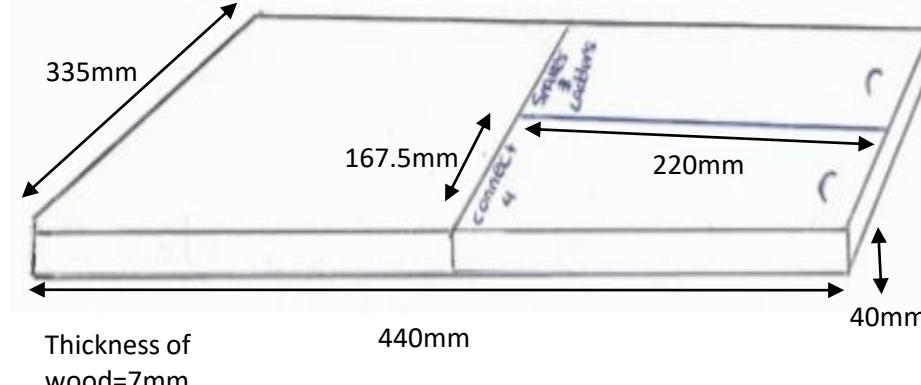
On this page I will be analyzing the final product that I will start manufacturing.

Now that I have modeled my product several times, developed it and analyzed materials, joints and finishing treatments, I just need to evaluate how the overall final product will look to make it clearer.

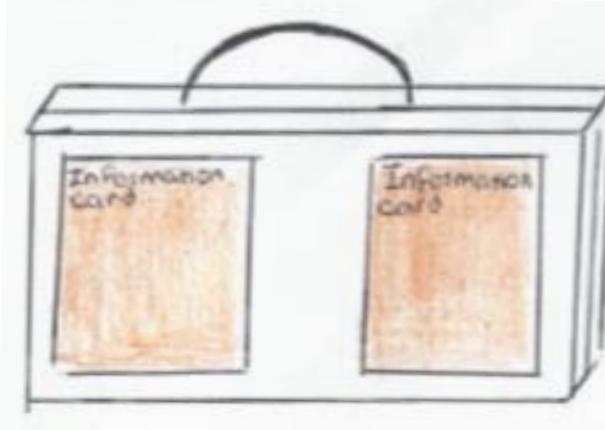
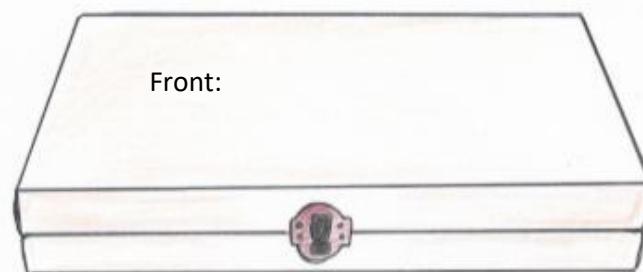
## Size:

The product size has changed compared to the original product on page 40, both the frame box and board became bigger to better meet the criteria and so the product can be used more efficiently. All the sizes have also been justified on page 63

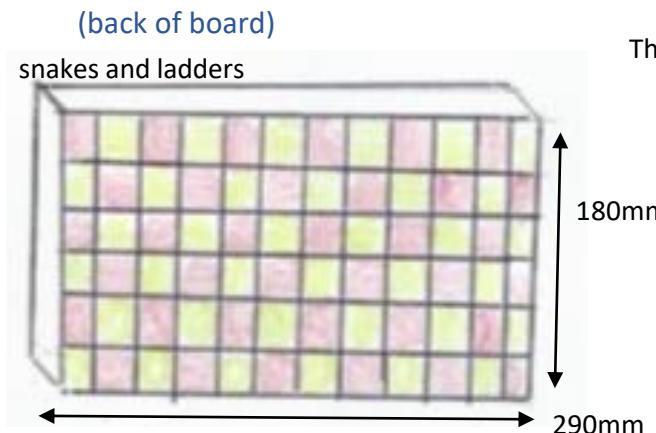
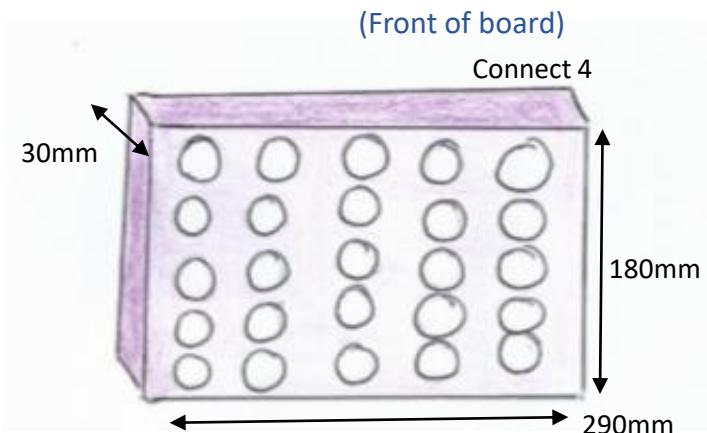
## When the product is open:



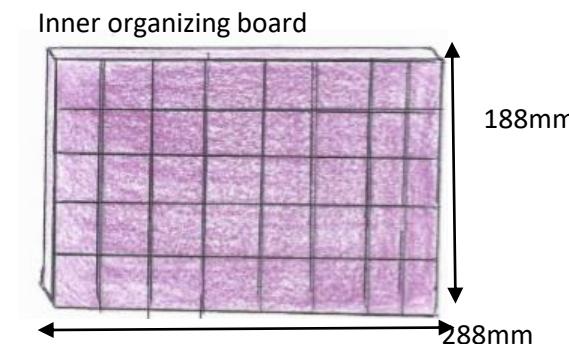
## When the product is closed:



Back:



Thickness of wood=6mm



## Function:

The main function of the board is still the same however the way the product works has been changed (for example, the board now stays on one section of the box whereas in the start the function of the board was that it would move around with a stand in the middle). By developing the function the product can now work more sufficiently and the product meets the specification better.

## How this product meets the design brief and product specification:

As the product contains board games, it somewhat forces interaction, as for example the connect 4 game requires more than two people to play and the same thing with the snakes and ladders. As the games require more than 2 people it sparks an interaction which can hopefully grow as the number of people playing the product increase. This will resolve the problem of 'interaction' in a playground. The organizing inner board and organizing slots inserted into the frame also encourage organization as, while the kids play with the connect 4 game the discs would automatically fall through to the organizing board, pulling out the organization board to reorganize the discs will then amuse them, as it acts as a transformer (pulling out parts to rearrange the structure of the product), and as for the organizing slots, it gives the children no excuse to leave the place messy behind them.

## Joints:

- For the frame of the product, rebate joints will be used to connect the stands of the board with the base.
- Finger joints will be used to connect the sides of the product together (ensures strength of the frame)
- Sides of the box will be routed so the board can move through with a dowel..
- Housing joints will be used to insert slots of wood on the opposite side of the box for the organizing purpose so box can be divided
- Hinges will be used to connect acrylic for the organizing side of the box.
- For the board: rebate joints will be used to connect the stand of the sides with the boards
- Finger joints will be used to connect the sides of the box together.

As discussed before there will be a zoo animal design stickered onto the front of the box.

# Process and Techniques:

On this page I will be outlining the process' I will be taking as well as finalizing the material I will be using.

## Techniques and process':

- I will cut out the materials into the sizes that I need them for the product using a table saw.
- I will then mark out finger joints on all sides of the frame and cut them out using a tenon saw and coping saw
- I will then rebate one side of the all the side pieces so that they can fit onto the base
- I will then use the laser to mark crosses where I will drill out holes for the connect 4 game
- I will then use a pillar drill and fortsner bit to drill out holes for the connect for game
- I will then mark out the finger joints for the sides of the board and cut them out using Tennon saw and coping saw
- I will then rebate both sides so that both game boards can fit into them.
- I will then laser cut the slots for the inner organizing board and stick them down using PVA wood glue
- I will then nail the side slot of the side piece of the board game to the inner organizing board so it can be pulled out.
- I will then measure out the organizing slots and place the measurements into the laser cut.
- I will laser cut the organizing slots onto MDF and use the interlocking method, so they fit perfectly into each other.
- I will then laser cut 2 acrylic lids into the correct measurement that will fit over the organizing slots
- I will then route the sides of the frame so that the board can move through it
- I will then mark out a cross on both sides of the game board and drill a hole 6mm deep
- I will then cut a dowel to the correct size and stick it into the hole
- I will then paint the board pieces with a chosen color from those indicated on page 16
- I will then paint the frame pieces with one color, also of those indicated from the research page.
- After all the painting is complete, I will stick the pieces of the board game together,
- I will then stick down the slots into the organizing board
- I will then insert the board into the allocated frame and stick its side pieces around it.
- I will then drill hinges in the organizing board, so they connect to the acrylic lid allowing it to be lifted.
- I will then stick down magnets on the acrylic lid so that it can be magnetically shut
- I will then drill hinges onto the sides of the frames to connect the board frames together and form a box
- I will then place a lock on the front of the product to keep it from opening or avoid pieces of the product falling apart
- I will then print out all the designed stickers onto vinyl stickers and stick them on the allocated parts of the product.
- I will then test the product to make sure everything works
- If a part of the product doesn't work, I will carry out development/iterations.

## Final materials:

- The base of the product (frame) will be made from beech, because beech is durable, fairly cheap, does not get scratched easily and there is a lot in stock.
- The organizing box slots will be made from beech as well as beech is strong and will be able to handle pressure.
- The lids for the organizing box will be made from acrylic, as acrylic is see-through and will appeal better in the box, and helps children maintain organized.
- On the acrylic slots, vinyl stickers will be placed with the names of the game on each side.
- The organizing lids will close with magnets.
- The board will be made of MDF because MDF is tough and does not dent easily so will have a longer life span with children use.
- The organizing board inside the main game board will also be made from MDF because MDF is cheap and again fairly tough.
- The open slot that will allow the inner box to roll out will be close with magnets, which make it easier to function.
- The handle will also be made from beech, beech is tough and will handle pressure from children carrying it.
- Playing discs will be made from acrylic

# Does my design idea meet the product specification?:

\*points that I did meet will be highlighted\*

(Overall very successful)

Before starting to manufacture, I need to ensure that my design idea meets all the points on the product specification to ensure that the final product fully meets demands and criteria's.

Specification area	Specification point	Slide number	Explanation
<b>Form (A)</b> Total points(9)	A1- the product <b>must</b> include the colours(red, yellow, blue orange, green ,pink and purple) A2- the size of the product <b>could</b> be 899-1524mm (length) and 965.2mm (wide) A3- the product <b>must</b> be colourful and organized A4- the product <b>should</b> be fun and interactive	A1- 14 A2- 15 A3- 14,5 A4- 14,15,3	A1-as demonstrated by my research, these are the colours that attract children's eyes. I can test this by asking the children what colour in my product they like the most. A2-these are the measurements of heights is the average height of my demographics age, and the width is enough to allow several amounts children to use my product at the same time. A3- according to the interview in the start of my research that is what the playground really lacked A4- according to my interview children enjoy being interactive during break time.
<b>Function (B)</b> Total points(5)	B1- the product <b>must</b> be made of durable timbres that can handle outdoor weather conditions and should be immune to insect and rot. B2- the product <b>should</b> contain some sort of structure that allows the product to be organised	A1- 16,10 A2- 13,8, 5	B1- my product is going to be situated outdoors since it is made for a playground, and so it should be able to handle any type of weather condition and should be able to fight off rot and insect attack. B2- this will meet the needs of the user and will make playtime pass faster and at ease.
<b>User requirement(C)</b> Total points (7)	C1- the product <b>could</b> be knock down fitting C2- the product <b>should</b> be no less than 10 k and no more than 30 kg. C3- the product <b>should</b> not be too complex C4- the product <b>should</b> be rounded and safe. C5- the product <b>must</b> be playable by both girls and boys	A1- 17 A2- 15 A3- 14 A4- 13,14	C1- this will make Transportaion easier, so that the buyer could place everything together, and so there is no breakage during shipping, also doesn't require Maintenace when it arrives. C2- his means that the product will be stable and would fall over no matter the weight of the user. C3- this avoids injury and wouldn't require much supervision C4- also avoids injuries to do with sharpness.
<b>Material and component requirement(E)</b> Total points (13)	E1- materials <b>must</b> be environmentally friendly E2- materials <b>should</b> be available in the workshop E3- the product <b>should</b> contain various materials E4-the product <b>must</b> be made of mostly wood E5- other materials like polystyrene and steel <b>could</b> be used but <b>should</b> be used in small quantities	D1- 16 D2- 16 D3- 16 D4- 16 D5- 16	D1- my main objective is to decrease carbon footprint through my product. The less waste I make, the less the cost of the production will be. I can test how much waste is made by calculating how much of the material I used D2- since I am working in a workshop, I can only use material from there D3- wood will not be able to succeed in every function, so other material is necessary D5- to lessen the use of crude oil and energy can test this by measuring how much of the material is used.

# Manufacture:

\*Times at which developments have taken place will be highlighted\*

Developments taking place will be highlighted in yellow

I will now begin manufacturing my product, through this process I will be using a range of materials, tools and techniques. And if I encounter a problem, developments will take place. And developments that will take place will be highlighted. To organize the manufacture, process will be written on the table and pictures will be placed below.

step	process	Tools and machinery	Safe working practice
1	I first had to get the materials cut into the correct sizes, so by using a table saw I got all the necessary materials cut, and this would speed up the process as material would already be ready, I would just need to cut up the joints. However the main problem was that because there was no enough material (beech) that would fit the length of the base of the product, we had to cut 3 slots of equally wood that would be glued together and then form the base.	Table saw Beech MDF	As using a table saw is very dangerous, I got help from an experienced person
2	Secondly I had to start cutting up the joints for the base (frame) of the product, however due to the fact that there was not enough beech material for the base of the product, changes needed to be made, because using beech was a vital part of the product and glueing together 3 slots wood be insufficient and make the product weak, so I decided to cut up MDF of the size of the base and then it would be veneered with beech so the base still has properties of beech even though there was not enough beech for the size of the base.	Veneer beech MDF	
3	Now that I found a solution for the problem of not having the correct size beech for the base, I needed to veneer the beech onto the MDF base. To do this, I cut up the exact measurement of MDF base (W= 335mm L=220 mm thickness=7mm) using a table saw. I then got the veneer beech and cut up the exact measurements for the base. Then I spread PVA glue all over the base using a glue spreader/scrapers and glued on the veneers to the MDF repeated on each side. Then using a veneer roller I ensured that there was no bubbles in between the MDF and veneer. I then got help setting up the bag press, and placed the veneer inside the bag press, ensured everything was in place and left it in the bag press over a few hours. I secured the sides with tape to ensure no movement was happening during the veneering process	Bag press Glue scraper Veneer roller MDF base Beech veneer Table saw PVA glue	Although pva glue is not toxic I tried to limit contact with skin and so used a glue scraper and waste pieces of card, and also made sure I don't contaminate other pieces of work, and once I was done with using the glue, I immediately washed my hands. I also made sure to wear an apron at all times to ensure that as well as the surrounding I don't get myself messy. Although bag press are not dangerous or complex, I made sure that the area was clear before use .



These were the pieces that were going to be stuck together, but as seen on the picture it was obvious that I would not handle pressure or joints well, so I alternated to veneered MDF



The cut-out veneers and MDF bases



Spreading the pva glue on the MDF bases



Veneering stage.

# Manufacture:

Developments taking place will be highlighted in yellow

\*Times at which developments have taken place will be highlighted\*

step	process	Machinery and tools	Safety working practice
3	While the veneer was in the works, I started working on the board, so I first started by producing the connect 4 game, to form precise and accurate holes I first got crosses lasered onto the game board, the crosses resembled the center of the holes which would each be 30mm in diameter , 29 mm space between each column and a 3mm space between each row.	Laser machine	
4	After the crosses where lasered onto the board I got a hammer and a small sharp center punch, and hammered lightly into the center of the crosses, this would then make it easier when using the pillar drill as the center would already be dented.	Hammer Centre punch	<ul style="list-style-type: none"> <li>As using a hammer could be dangerous and it is quite heavy, and any wrong movement could lead to serious injuries. I made sure I was at eye level to the board when I was hammering it, and also made sure that before I started hammering, my hand was steady, and the tip was accurately on the Centre. I also had adult supervision just in case anything goes wrong.</li> </ul>
5	Now that all necessary marking out for the drilling was done, I inserted a 30mm forstner bit into the pillar drill and started to machine the board and cut out the holes, using the pillar drill ensured that the process was quick and accurate.	Drill bit Machine vice Forstner bit.	<ul style="list-style-type: none"> <li>I fixed the board onto a machine vice to ensure that the board would not move during work, and so the product would not get ruined.</li> <li>Because the pillar drill cuts out material quickly, I wore safety glasses to ensure no flying dust entered my eyes.</li> <li>I also tied my hair back so it wouldn't distract me while I was working.</li> </ul>



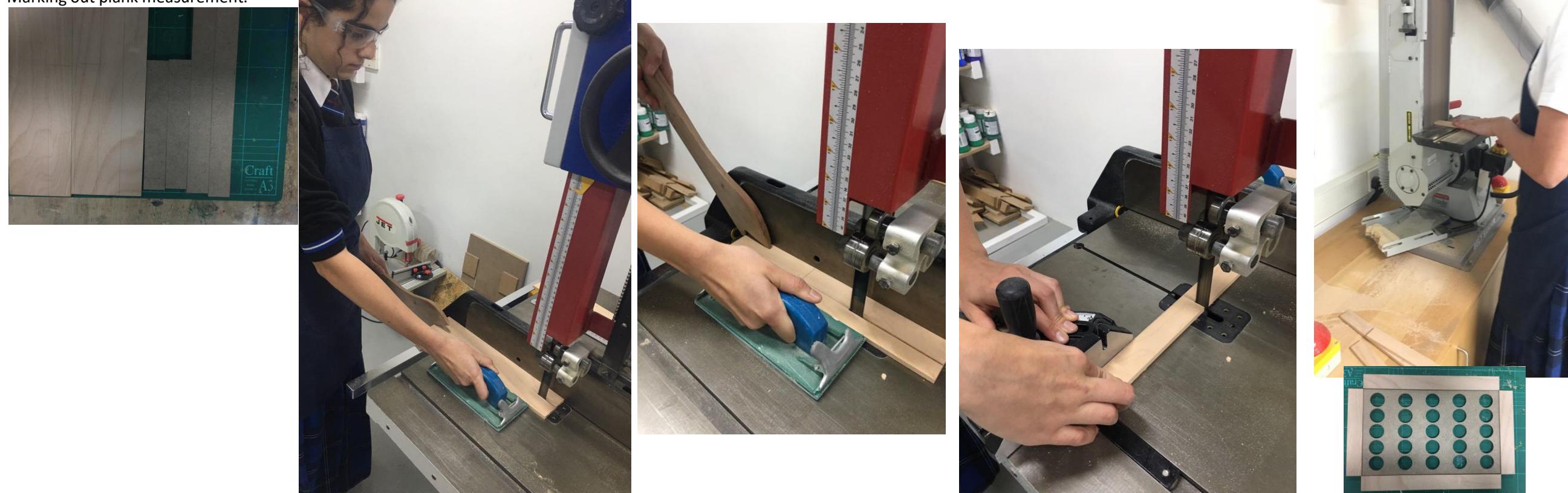
# Manufacture:

\*Times at which developments have taken place will be highlighted\*

Developments taking place will be highlighted in yellow

step	process	Machinery and tools	Safety working practice
6	<p>Now that I finished one side of the board, I started marking out joints onto the MDF sides for the board, however what I then realized that because MDF is made out wood dusts it will not form joints properly and will cause tears in the product, so instead of using MDF side for the board, I decided to use the waste Beech planks that were meant to be for the base, as beech is a hardwood and is tough so will stand pressure and wont tear, and so I will cut up the planks into the correct sizes so they can be used for the sides, this will minimize waste and help keep my product sustainable.</p> <p>So I started by marking out the exact sizes of the planks onto the pieces of the beech.</p>	<p>Try square Ruler MDF planks Beech planks</p>	<p>Although there are no safety precautions to make during marking out measurements, I still ensured that I was wearing an apron at all time and my hair was out of my face.</p>
7	<p>After I marked out the sizes of the planks, I went onto the band saw to trim up the planks. I first started by fixing the distance between the band saw and the barrier to ensure that the planks were cut to correct measurements, I then used a push stick and a gripper while I was using the band saw to ensure that I was not making any contact with the band saw itself so I wouldn't risk injury. Once I cut straight through the planks, I remeasured the distance between the plank and barrier and used a bandsaw mitre gauge to cut across the planks. This process produced accurate planks of beech for the sides of the board.</p>	<p>Band saw Gripper Bandsaw mitre gauge Push stick Safety goggles. apron</p>	<ul style="list-style-type: none"> <li>Using a bandsaw is very dangerous as the blade is very sharp and fast, so to avoid injury I used a push stick and a gripper, so my hands were not anywhere near the actual blade</li> <li>I also wore safety glasses to make sure no flying material would end up in my eyes..</li> <li>I made sure my hair was tied up to avoid distractions</li> <li>I also made sure to keep focus while using the bandsaw as slight distraction could lead to something major.</li> </ul>
8	<p>I then sanded all the planks of wood using the b to ensure all sides were equal and the same size.</p>	<p>Sanding machine. Safety goggles apron</p>	<ul style="list-style-type: none"> <li>I turned on the sand vacuum before I started sanding to ensure that all dust was sucked away and wouldn't go flying about or fly in my eye.</li> <li>I also wore safety goggles so that no dust would fly into my eye.</li> </ul>

Marking out plank measurement.

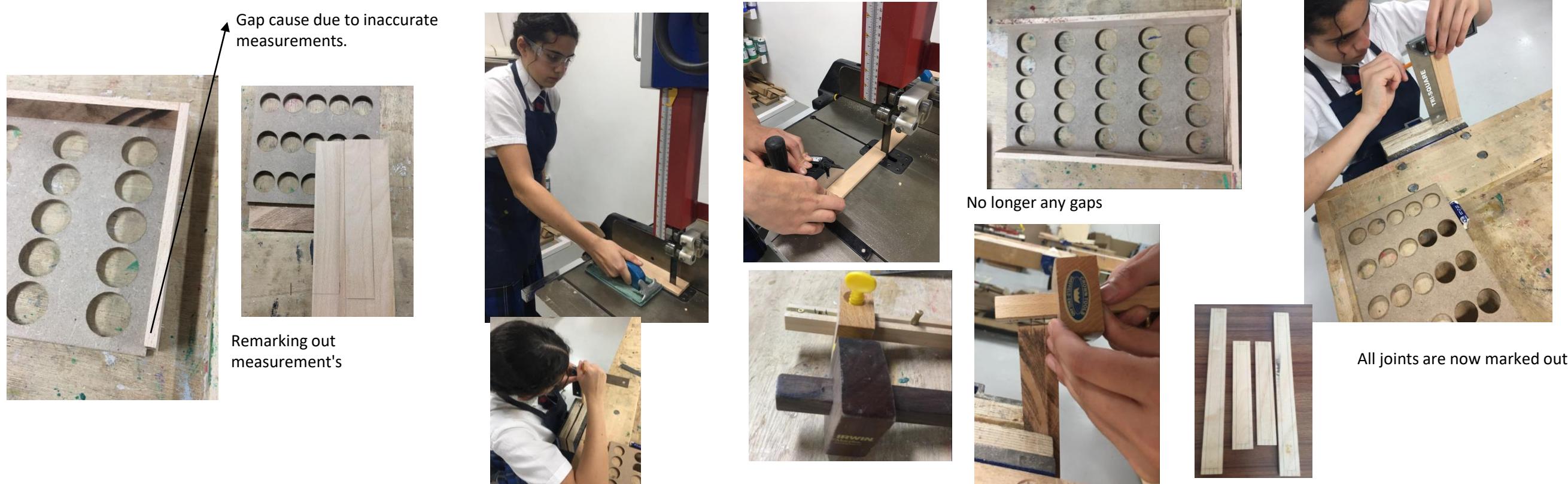


# Manufacture:

\*Times at which developments have taken place will be highlighted\*

Developments taking place will be highlighted in yellow

step	process	Machinery and tools	Safety working practice
9	<p>At this stage I was meant to draw up and cut the joints for the board, however when I aligned the pieces of woods together on the edge of the board, I realized that there was a <b>gap of missing material</b>, and this was because the beech thickness is 7mm whereas the MDF' board thickness is 6mm as established on the final product page, because I was not planning to have beech as the side material for the board it led to beech being thicker than the MDF that was cut up, however this will not impact the product that much., this gap would then not allow the joints to work. So instead of remarking and re cutting all the sides again, I only <b>remarked the side ones</b> (height- 180mm and width of 30mm) and this would allow all the planks to join together. Once I remarked the 2 sides, I repeated the process again with the band saw to cut out accurate slots. And then I sanded the material again.</p>	<p>Try square Ruler Band saw Sanding machine. Push stick Gripper Band saw miter gauge</p>	<ul style="list-style-type: none"> <li>I work safety goggles through the whole process</li> <li>Used the push stick and gripper while using the band saw</li> <li>And ensured that the dust Vacuum was turned on while using the sanding machine and the band saw.</li> <li>While I was using the band saw, I made sure that the saw stop moving completely before picking material around the saw.</li> </ul>
10	<p>Now that all the sides were of the correct measurements, I started marking out the joints for the sides of the board, (rebate to connect board to the planks , and finger joints to connect the sides together). I started by measuring the correct distance (6mm) on the edge of the plank which is where the board will lay, I repeated on each edge of the planks, and then marked halfway (0.5mm) deep into the planks and again repeated with all the planks, because the cut out beech is thicker than the MDF used I had to mark out 1mm deeper in the rebate joint so that the joint still had the same effect and that there wasn't any extra material., once the rebate joints where done, I started marking out the finger joints, drawing a line every (0.6mm) in the space in the middle where the rebate joint wasn't occupying space using a try square and a marking gauge to ensure all lines where parallel and at right angel., I then marked across the planks (0.8mm) with a try square again and joined the marks together. To ensure all lines were accurately drawn, I made sure that I was at eye level or above while marking out the joints so that they were all precise.</p>	<p>Try square Ruler pencil</p>	<ul style="list-style-type: none"> <li>Although marking out joints with a pencil and a try square does not have any danger issues, I ensure that I was being safe with the equipment and was taking precise measurements.</li> <li>To ensure that all the finger joints were of the same measurements, I used two marking gauges, set at the correct distances (first one was 7mm deep- create the line across the plank) (and the other was (0.6mm apart- crate the two lines for the finger joint), his ensured that the joints would connect together equally and precisely.</li> </ul>



# Manufacture:

\*Times at which developments have taken place will be highlighted\*

Developments taking place will be highlighted in yellow

step	process	Tools and machinery	Safety working practice
11	<p>Now that all the joints have been marked out, I began cutting them out, I first started out by cutting up the finger joints, I did so using a tenon saw- for the top of the joint, as well as a gentlemen saw- when I got closer to the end of the markings, for more accurate precise cuts and a coping saw to remove the blocks. Once the cuts were finished, I filed them down if there were any excess, uneven material. However after I finished cutting out the finger joints, I tried connecting the sides together, but I found that <b>more needed to be cut out so that they can go inside each other</b>, as there were sides that were enabling this from happening, so I preplanned the sides with the same method and cut them off.</p>	Coping saw Tennon saw File Gentlemen saw	<ul style="list-style-type: none"> <li>I made sure to use all sharp tools (tenon saw, gentlemen saw, and coping saw) with precautions as it can lead to minor injuries.</li> <li>I continued wearing an apron through this whole procedure.</li> </ul>
12	<p>Now that the finger joints were complete, I went on to forming the rebate joints, for this I used a rebate plane, I started by setting up the correct distance in the plane(6mm), I then set up the work space, by laying a large thick board and keeping it in place using clamps (plays the role of the working vice- so that I don't curve any hole/scratches onto the actual working bench), I also placed the planks in position with clamps to ensure that there was minimal movement. before continuing on the final planks, I first tried it out the rebate plane on a waste plank to ensure that all measurements were correct and that it worked efficiently. At first I used a clamp to keep my planks in correct position, however it was difficult and the other side of the plank that was not clamped continued to move around, so instead I stuck double sided tape onto the board that acted as the working vice and continued by placing down the plank on the double sided tape, this surprisingly worked much better than using the clamps and there was no movement of the planks, so it helped the procedure flow more smoothly.</p>	Rebate plane Ruler Thick waste board (working vice) Double sided tape clamps	<ul style="list-style-type: none"> <li>While using the rebate plane, I ended up using gloves while working as my hands were to slide between the plank and plane it would lead to many scratches</li> <li>I also wore an apron through the whole process.</li> </ul>



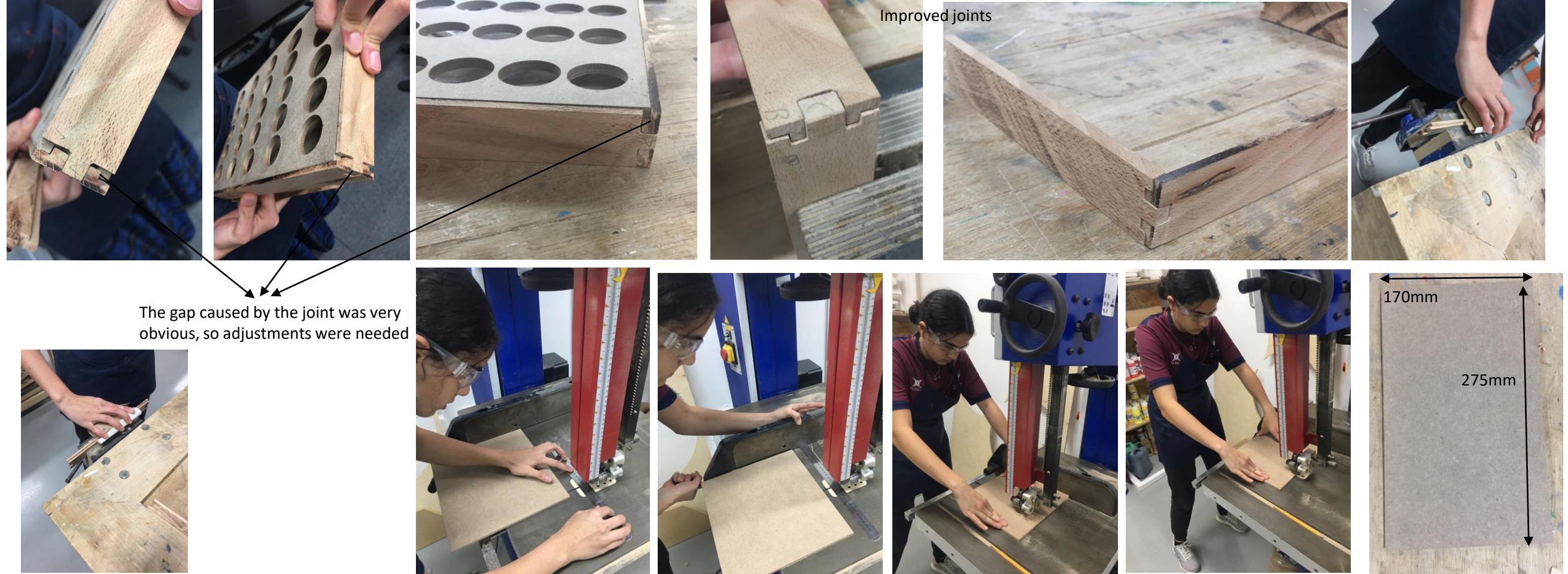
Completed finger joints

# Manufacture:

\*Times at which developments have taken place will be highlighted\*

Developments taking place will be highlighted in yellow

step	process	Tools and machinery	Safety working practice
13	<p>Now that I finished completing the rebate joints on all sides of the board, what I realized that because of the rebate running down the full length of the board when the sides joined together, there was a gap caused due to missing material, so instead of using wood fill to fix this problem, instead I recut out to sides of the board (180mm length, 30 mm width) using the band saw and re did the joint, and instead of removing the sides to form finger joints I would cut them half way through so that the material fit the gap this would produce an 'L' shaped joint on the sides, although this was a complex shape/joint to deal with it was more efficient than using wood fill.</p> <p>Once I finished doing all the joints, I sanded them all to take away any burns that were caused during machinery.</p>	<ul style="list-style-type: none"> <li>Band saw</li> <li>Marking gauge</li> <li>Ruler</li> <li>Try square</li> <li>Tennison saw</li> <li>Coping saw</li> <li>Band saw mitre gauge</li> </ul>	<ul style="list-style-type: none"> <li>I followed the same safety precautions taken previously when dealing with the bandsaw (use of push stick, griper and mite gauge-apron and hair away from my face)</li> <li>While using machinery I ensured that the vacuum was on first</li> <li>When cutting out the joints I took careful and slow steps to ensure measurements were correct and to avoid redoing the joints again.</li> </ul>
14	<p>Now that the problem with the joints has been fixed and the board was finally complete, I moved onto the inner board which is used for organization purposes (easier to remove discs from the box when finished playing). I first had to cut up the board into the correct size, to do this I got a 6mm thick MDF board, I then started setting up the correct measurement of distance on the band saw- first measurements was 275mm as that is length the board will be. After cutting up the measurements, I then went on to remeasuring the distance on the band saw to 170mm which is the width, and then again cutting up the board into correct size.</p>	<ul style="list-style-type: none"> <li>Band saw</li> <li>ruler</li> </ul>	<ul style="list-style-type: none"> <li>This time while using the band saw, I was cutting up a board from more material, so I did not need to use a gripper or a push stick as it was safe enough to use my hand to guide the wood through the band saw</li> <li>However I did still follow basic safety precautions, such as tying my hair back, wearing an apron and focusing while using machinery.</li> </ul>

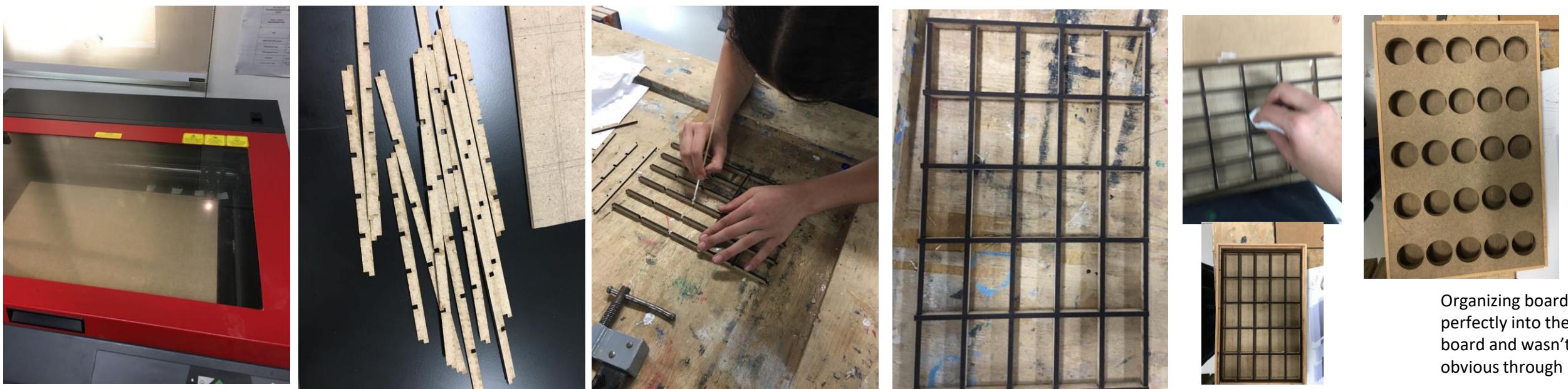
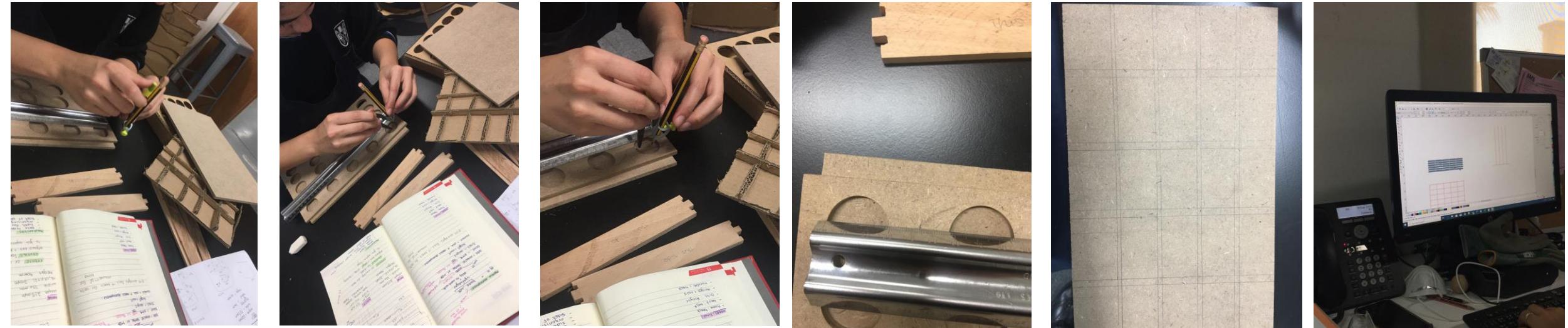


# Manufacture:

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Developments taking place will be highlighted in yellow

step	process	Tools and machinery	Safety working practice
15	With the organization board now complete, I now had to start plotting measurements and distances on that board which will mark out where the slots go and these slots while each hold a disc once inserted. To mark out the measurements accurately, I first placed the original board ( 4 in a row) on top of the organizing board, then got a compass and measured it to 15mm (the radius of the circle) with this I then plotted the centers of the holes, doing this ensured that with the slots there would still be enough space to for the discs to fit. After I measured out the centers, I went on to marking across the board in columns and rows, each were 41mm apart.	<ul style="list-style-type: none"> <li>• Compass</li> <li>• Ruler</li> <li>• Try square</li> </ul>	
16	Now to form the columns and rows, I used the laser cut as the measurements would be too small (9mm width and 275 + 170mm length) to use and machinery by hand, so on the laser cut we used the lock mechanism by setting it into all of the drawn joints. Once the joints were lasered out, I went ahead and assembled them to ensure that they fit perfectly and once they did, I went onto glueing them with pva wood glue.	<ul style="list-style-type: none"> <li>• Laser cut</li> <li>• Pva glue</li> </ul>	<ul style="list-style-type: none"> <li>• The laser cut is not dangerous in use and the machine does everything.</li> <li>• But when it came to using the pva to stick the pieces together, I wore an apron and also ensured that my workspace was clean so that I didn't damage anything.</li> <li>• Any glue that dripped was immediately cleaned.</li> </ul>



# Manufacture:

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step	process	Machinery and tools	Safety working practice
17	Now that I have finished the game board, I had to move onto the box (product frame). The bases had now finished veneering, so it was time to work on them. I started off by removing extra side veneers from the base, using a x-acto knife and a ruler to ensure that the veneers didn't rip. After removing all the excess veneers I went on to sanding the sides of the base using a sanding block to make sure that any dried glue or tiny pieces were removed, leaving behind a smooth surface, I also used a sanding block instead of a belt sand to make sure that I had control of the base and so the veneer doesn't rip.	<ul style="list-style-type: none"> <li>Exacto knife</li> <li>Ruler</li> <li>Sanding block</li> <li>Sanding paper</li> </ul>	<ul style="list-style-type: none"> <li>While using the x-acto knife I was focused to make sure that I had control of the base, so it doesn't lead to injury or possibly ripping the veneer</li> <li>While using the sanding block, I made sure to wear an apron and safety goggles to make sure no tiny pieces flew into my eyes.</li> </ul>
18	Next I was going to move onto making the joints for the sides of the base, but before I started I realized that <b>the main base was way bigger than the board base size</b> , so adjustments had to be made, as I didn't want the dowels sticking out of the sides of the board to show that much. So instead I marked around the base with the side pieces of the board so that while marking down the width the thickness of the sides was encountered. I then marked out 10mm from the side which will be removed. This will make sure that the board will fit the box better and more appealingly. After marking out the sides, I went on the band saw and trimmed them off. I then re positioned the base of the board onto the frame base to make sure that it fit better, and it did.	<ul style="list-style-type: none"> <li>Ruler</li> <li>bandsaw</li> </ul>	

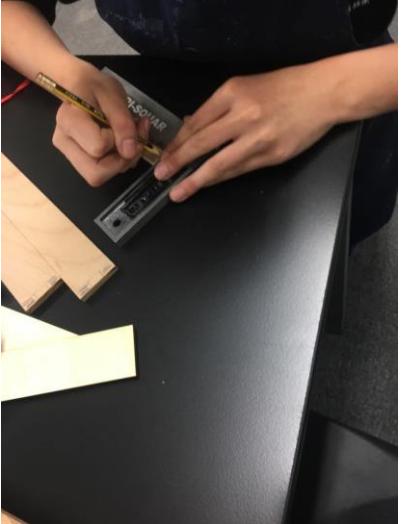


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step	process	Machinery and tools	Safety working practice
19	Now that the board sizes were adjusted, I had to move onto making the finger joints for the sides of the base, I started off by marking out my measurements with a try square and a pencil, each gap was 14mm wide. There were many joints that had to be made, so I had to use a batch procedure. So I first started by getting a jig laser cut with the exact measurements of the finger joints that were going to be made (14mm gaps ).	Laser cut Try square Ruler jig	
20	I now had to set up the band saw so that I can batch produce the joints, I first had to start off by cutting straight slots in the gaps.. I got a waste plank to wood and measured 12mm deep into the band saw (12mm will be cut through the wood), I then clamped this plank of wood. (the wood will help ensure that the band saw does not cut more than 12mm. I then started measuring out the distance between the blade and the blade guard (14mm), this is the distance between each gap in the finger joint), the jig helped ensure that the measurements were correct. After finished the set up, I did a trial test with the jig to make sure that no extra pieces were taken off, this confirmed that the set up was correct.so I went in and band sawed both sides of all pieces.	Band saw Wood plank Clamp Ruler jig	<ul style="list-style-type: none"><li>While using the bandsaw I made sure to wear a safety apron and goggles at all time to ensure no flying dust ended up in my eyes.</li><li>While measuring out distances on the bandsaw, I made sure it was turned off</li><li>And while using the band saw I made sure to have supervision at all time.</li></ul>



# Manufacture:

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step	process	Machinery and tools	Safety working practice
21	Now that the slots in the finger joints were all done, I had to rearrange the measurements to cut off the side gaps on some of the joints that will only have the middle part. To do this I increased the measurement between the blade and blade guard by 2 mm (16mm) making the measurements bigger meant that the middle part will be bigger and will fit with the other parts better. I kept the same set up to continue to ensure accuracy when cutting. I also used a miter gauge to lower the joint into the blade safely.	Band saw Ruler Miter gauge	<ul style="list-style-type: none"> <li>I continued to make sure safety goggles and safety apron were on at all times</li> <li>I also had supervision at all times.</li> </ul>
22	With the side parts now removed, I had to remove the middle parts of the joints. To ensure accuracy and precision I used a chisel. The technique I used was that I scored through the middle of the joint with an x-acto knife and a try square to make sure that the chisel fit well into the mark and wouldn't move while working. I then set up a bench hook and got a mallet and hammered through the middle of the joint with the hammer and chisel, ensuring that the flat bit of the chisel was facing me to make sure the cut was flat. Doing this ensured that all cuts were exactly the same and had a better fit. When I came to join the joints together, they were all perfect fits.	Mallet Chisel X-acto knife Try square Bench hook	<ul style="list-style-type: none"> <li>While using the x-acto knife I made sure to be aware of the placement of my fingers</li> <li>While using the chisel and mallet I ensured to keep safety goggles and apron on, so no pieces flew into my eyes.</li> <li>I also made sure that I was in control of the mallet and I was using it sensibly, so I don't injure myself.</li> </ul>

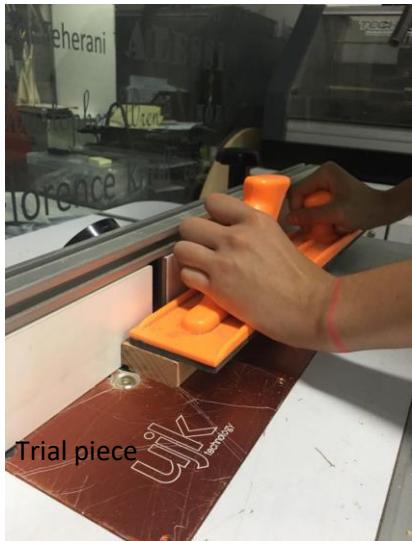


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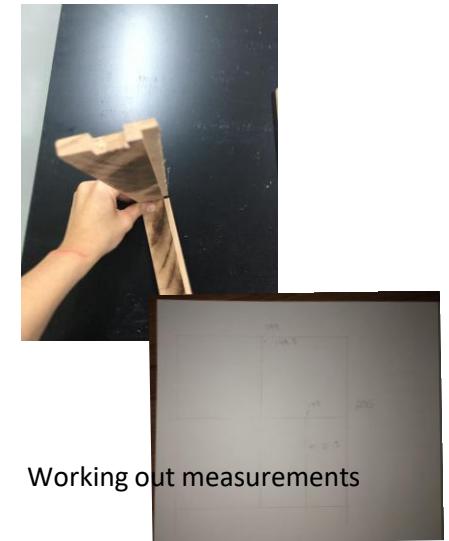
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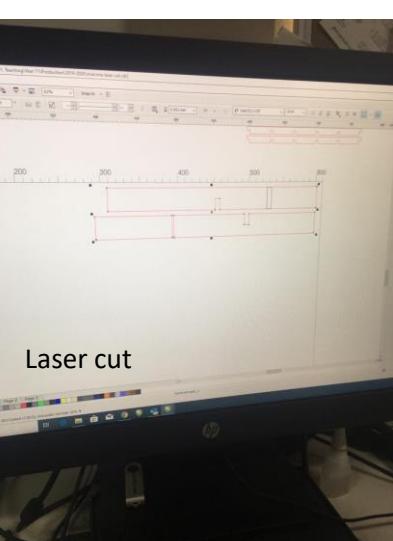
step	process's	Machinery and tools	Safety working practice.
23	I now had to connect the sides with the base, to do this I had to make rebate joints. The thickness of the base and the sides are both 7mm, so I started by setting up the blade to a height of 3.5mm so that it cuts exactly halfway through the sides. And I then made sure that the length throughout the rebate table was the same. Before trying out the rebate on my actual sides, I tried it on a waste piece, while using the rebate machine I used a gripper with all pieces for safety and accuracy., and after making sure that all the measurements were correct, I went on to repeating this on one side of all my side pieces. And after repeating the rebates on the sides, I also rebated the sides of the base to make sure they all fit into each other .I used the same measurement of 3.5mm blade and rebated each side of the base. And after finishing I fit them together and their fit was perfect.	<ul style="list-style-type: none"> <li>• Rebate machine</li> <li>• Ruler</li> <li>• gripper</li> </ul>	<ul style="list-style-type: none"> <li>• While using the rebate machine I wore a mask, goggles and apron at all times to ensure no flying dusts ended up in my mouth or eyes.</li> <li>• I used a gripper to lower my sides into the blade safely and precisely.</li> <li>• I had supervision at all times.</li> </ul>
24	After ensuring that all the rebate sides and bases were perfect , I went on to making my organizing board (where the game pieces will lay). To do this I first worked out the measurements that would fit into the board, to do this I just used a calculator and original measurements of my board. After figuring out all the measurements I then got them laser cut with the interlocking method, so they fit perfectly into each other. Once they were laser cut, I fit them into the board and their fit was perfect. I then went on to sanding them to take off laser burns.	Ruler Laser cut Sanding block Sandpaper Machine vice	



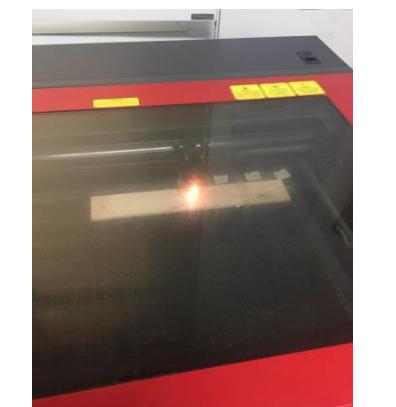
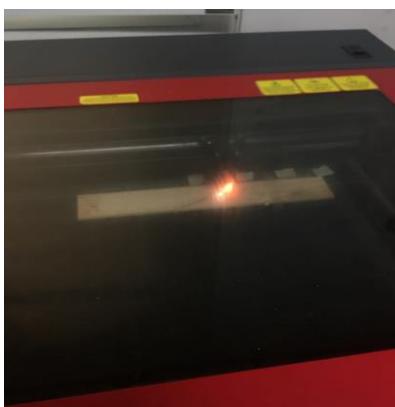
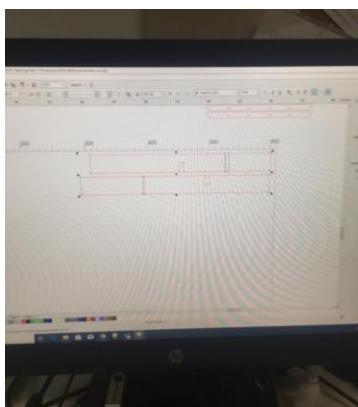
Actual pieces.



Working out measurements



Laser cut

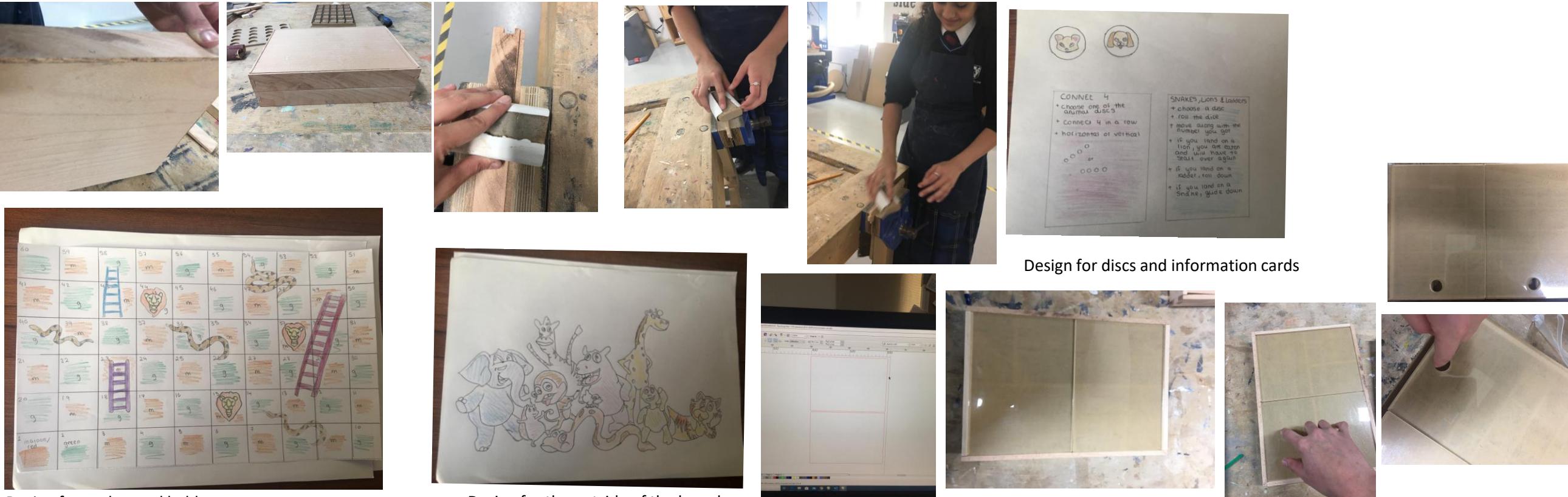


# Manufacture:

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step	process's	Machinery and tools	Safety working practice.
25	now with all the rebate and finger joints complete for the base of the product, I have to sand each piece to take away any burn that was produced during manufacturing.	Sanding paper Sanding block	I placed the pieces into a machine vice while sanding And made sure to clean the sand off after a while so the buildup of sand doesn't fly into my eyes.
26	Now that the main pieces of my product have been completed, I had to start thinking about the design of my product, since I will be mainly using stickers so that color can be shown on the designs, I began sketching out and coloring the designs that I wanted in my product. These designs will then be factorized to produce stickers.		
27	To finalize my organizing board, I had to cut out the slots of acrylic that will act as a lid for the organizing board, this will then avoid mess in the box by the small pieces falling over each other.to cut out the acrylic slots, I inserted the measurements into the laser cut, and the got them laser cut, I also ensured that the slots were curved to avoid cuts to small children.	Laser cut	There are no safety precautions regarding using a laser cut as it is computer aided.
28	After the lids were finished being laser cut i realized that there should be an added mechanism to them so that they can open. So with the same template on the laser cut I placed a 18mm diameter circle 10mm above the center. I had the circles at 18mm so that there isn't a possibility of any fingers being stuck in the whole, and so the hole fit any thickness of fingers. And having the hole 10mm above the center allowed the lids to be opened with the force balanced throughout the surface.		



Design for snakes and ladders game

Design for the outside of the board

Design for discs and information cards

# Manufacture:

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step	process's	Machinery and tools	Safety working practice.
28	i now had to laser cut acrylic discs for the connect 4 games, instead of making all the discs of out acrylic, I decided that half (the cat discs) would be made from acrylic and the other half (dog faced discs) would be made from pewter casting colored acrylic dog faces onto metal discs, these two contrasting materials would then contrast the two animals (dogs and cats). I first started off by making the acrylic discs. I measured the width of the inner organizing board (29mm) along with the width of the connect 4 board (30mm) as well and the thickness of the board to ensure that the discs fits properly into the board and doesn't stick out (6mm)I also went on to measuring the thickness of my fingers (13mm)- I did this to make sure that there would be gaps around the blocks so the children would be able to pick up the discs after playing. After all the measurements, I concluded to a diameter of 28.2mm for the discs. But before finalizing this measurements I did a trial piece and tried it through the game (putting it through the hole and trying to pick it up) when I found that the measurement was perfect I went on to lasering 8 more of the acrylic discs (there will be 9 discs per animal). I also concluded to using acrylic of thickness 5mm and this measurement was sufficient in ensuring the discs doesn't pop out the dame.	Laser cut machine	There are no safety precautions regarding using a laser cut as it is computer aided.
29	Now with the acrylic pieces done, I moved onto making the pewter casting discs. I satrted off by choosing a picture of a cartoon face dog that I wanted, we then went on to the computer and started editing it so we only got the outline, when this process was done, I chose the colors I wanted for the dog, and one at a time, each section of the dog was placed under the laser in the colored acrylic and laser cut out. Once all the pieces were done, I assembled them all together. Carried out the whole casting process and the end result was great.	Laser cut Computer Pewter casting machine.	While using the casting machine I made sure to wear gloves and an apron at all times to avoid burn if there was any spillage of molten pewter. I also made sure to be supervised while using the machine.

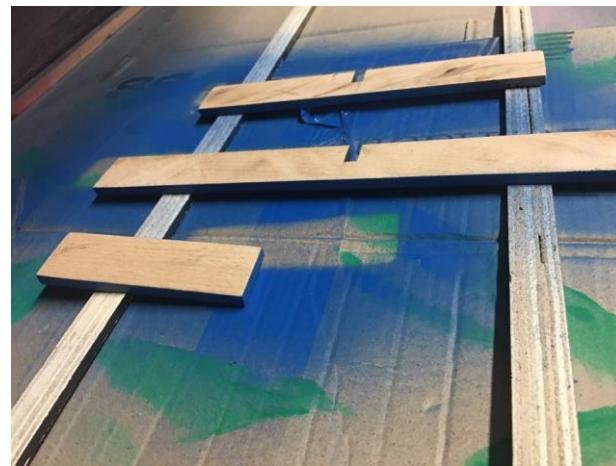


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step	process's	Machinery and tools	Safety working practice.
30	The pewter casting discs results were really nice, however, due to the lack of resources for pewtering I had to result back to acrylic discs. However if I was to industrially make this product, I would stick to the first plan of making half in acrylic and the other half in acrylic pewtered metal. with that done I got 9 more acrylic disks laser cut for the dogs disc.	Laser cutting machine.	
31	With all the pieces of the organizing board basically completed, I had to begin painting them. I began by sanding the slots one more time to finalize them for the spray paint. Once they were sanded, I placed them inside the spray paint ventilation (turned on) machine with two waste plank beneath the slots to ensure they don't stick to the cardboard. I then got blue spray paint and sprayed even streaks over the slots. After applying one layer, I waited for it to dry then applied another layer, I continued to this until both sides of the slots were completed. I then took really fine sandpaper (p240) and lightly sanded the surface of the slots to take away any rough texture.	Spray paint ventilation machine P240 sandpaper Spray-paint	<ul style="list-style-type: none"> <li>Whilst spray painting, I ensured that the spray slots were in the ventilation machine throughout the whole process to ensure that no toxic chemicals would diffuse around</li> <li>Even though the slots were in the ventilation machine I also wore a mask for extra safety as well as an apron.</li> </ul>
32	However, I ran out of spray paint halfway through spray painting the slots, so there were many discolored patches through the slots, and I was overall unsatisfied with the color, so I tried sanding off a layer of thickness of spray paint on the layer of the slots. I then went in with blue acrylic paint and a roller and painted the slots. I painted one side and then waited for it to dry then switched the side of the slot and painted the other side. I wasn't satisfied enough with the plain blue, so I decided to sprinkle white paint all over the slots as well as dark blue paint. I was very satisfied with the final result and I thought it looked war better than the beginning results, and it was also a very fun design for children.	Acrylic paint Paint roller	<ul style="list-style-type: none"> <li>While painting I made sure my area was clear and that there was cardboard underneath my work</li> <li>While splattering paint on the slots I made sure that I wore goggles so that no paint was to end up in my eyes.</li> <li>I made sure no one else's work was around so my paint doesn't end up on there's.</li> <li>I made sure that the acrylic was washable from skin so that when I ended up with paint on my hands it was washable.</li> </ul>

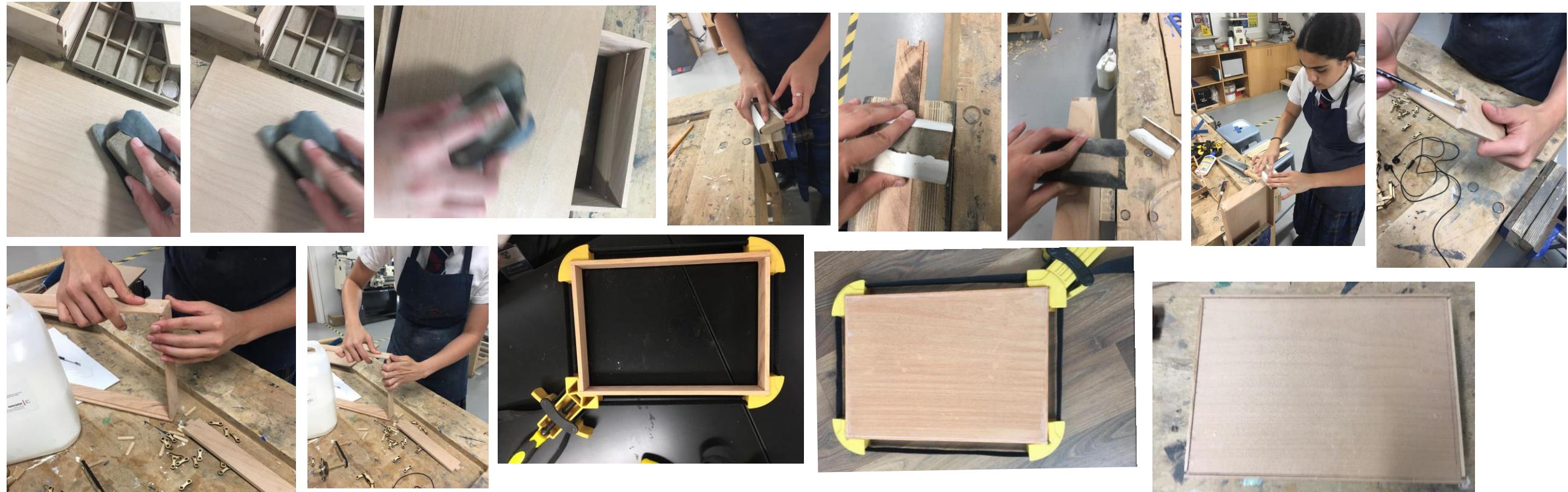


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step	process's	Machinery and tools	Safety working practice.
33	With the organizing slots complete, I moved into the base that these slots belong too and began sanding them, along with sanding the base. While sanding the pieces I placed them into the working vice so they don't move around and so they were sanded evenly throughout the length of them. To sand the sides I used rough sand paper (60 grit) to remove any burns that were caused during manufacturing and after the burns were gone i went in with fine sandpaper (p240) to give the sides a smooth surface, however for the bases (the veneered MDF) I sanded them with only p240 sandpaper so that the veneer doesn't get scratched and so that the base is left with a fine smooth surface.	P240 sandpaper 60 grit sandpaper Working vice	<ul style="list-style-type: none"> <li>Whilst sanding the planks I placed them into working vices so that the plank was secure and so they were sanded evenly.</li> <li>While sanding I would brush away the dust often so there was no buildup of dust that could end up in other/ my own eyes.</li> </ul>
34	Once all the sides were sanded I them fixed them into each other and sanded the finger joints to make sure that they were smooth and at the same level/ ensuring that the sides overall were smooth. Whilst sanding them again. I placed the fixed joints into the working vice to ensure there was no movement, so they were left with an even smooth grain	P240 sandpaper 60 grit sandpaper Working vice	Same as above
35	Once I finished sanding the side planks and base and ensuring they were all smooth I began gluing them together. I first started by gluing the side planks, I applied generous amount of PVA wood glue into the gaps of the finger joints and then immediately joined the sides together, I repeated with all 4 sides, and once they were finished I immediately started gluing the base to the sides before the glue dried. And after all pieces were glued, I placed them inside a clamp to ensure that all sides dried at 90-degree angle. I then left the base to dry for a few hours, so I moved onto something else while it dried.	PVA wood glue Paintbrush clamp	<ul style="list-style-type: none"> <li>While gluing the pieces together I worked at a steady and fast pace to ensure that the glue doesn't harden before the joints were in their fixed position</li> <li>I ensured that the area I was working in was clear and after applying the glue I immediately wiped the extra glue that ran out of the sides.</li> <li>I put small amounts of pva glue on waste cardboard so that there wouldn't be any leftover waste glue in the end</li> </ul>

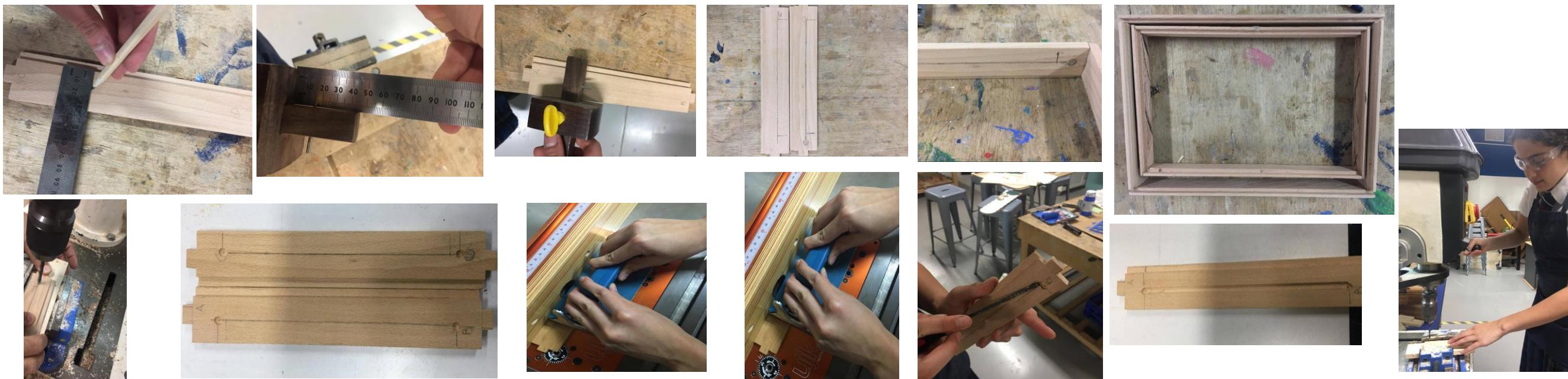


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step	process's	Machinery and tools	Safety working practice.
	<p>With one side of the board almost complete I then had to move on to the other side. As all the main pieces were now complete i had to focus on the mechanism of the board.to recall this is the mechanism the would allow the board to move around and rotate in the box, and this will be done by routing through the middle of the board, and to ensure that the board doesn't scratch the base while rotating there will also be a small route upwards from the middle route so that the board can be pulled upwards before rotating and being layed down to avoid scratches. And to ensure that the board lay down completely flat and wasn't 'floating' I had to make sure that the track and middle of the board met at the same level so it constantly layed at an equal level.</p>		
36	<p>To achieve this mechanism I first measured the distance of the middle of the sides (not including the rebated bits) the middle turned out to be 16mm away from the edge, I then set up a marking gauge at this distance to ensure equal measurement's through each piece. After setting the marking gauge at the correct distance I ran then through both sides then went in and remarked the lines I scored with pencil to make it clearer, before confirming these measurements I placed the board inside the base to ensure that the line leveled to the center of the boards center. I then took the pieces to the pillar drill so I can drill a small hole (using a twist drill) and each end which will mark the start and end of the track and it will also make it easier to route them. After doing so I took the pieces to the router and used a straight cutting bit, I adjusted the height of the route to the correct measurement (so that it is flat when placing the side pieces over it. When the route was set up I placed the drilled bits over the route drill and used a gripper to move the wood up until it stopped when it met the other hole on the other side. I repeated with both sides' planks. As for the upper length which was for moving the board upwards before moving, the original plan was to rote that as well, however this was <b>very dangerous and the route bit may get caught</b> into the wood and cause it to rotate or may cause the wood to fly off the board, so instead I decided to drill another hole in the space then file it to form a line , this Idea was more sensible and safe so I went forward with it. After drilling these hole I went ahead with filing them.</p>	<ul style="list-style-type: none"> <li>• Marking gauge</li> <li>• Steel rule</li> <li>• Router</li> <li>• Drill bit</li> <li>• Twist drill</li> <li>• Straight cutting bit (6mm thickness)</li> <li>• file</li> </ul>	<ul style="list-style-type: none"> <li>• As routing the upward mechanism was too dangerous, I switched plans to a safer technique (using the pillar drill) to ensure safety of myself and others and to also avoid any ruins of my product.</li> <li>• While using the machinery I continuously wore goggles and an apron as well as ensuring that I continuously had adult supervision for my safety.</li> </ul>

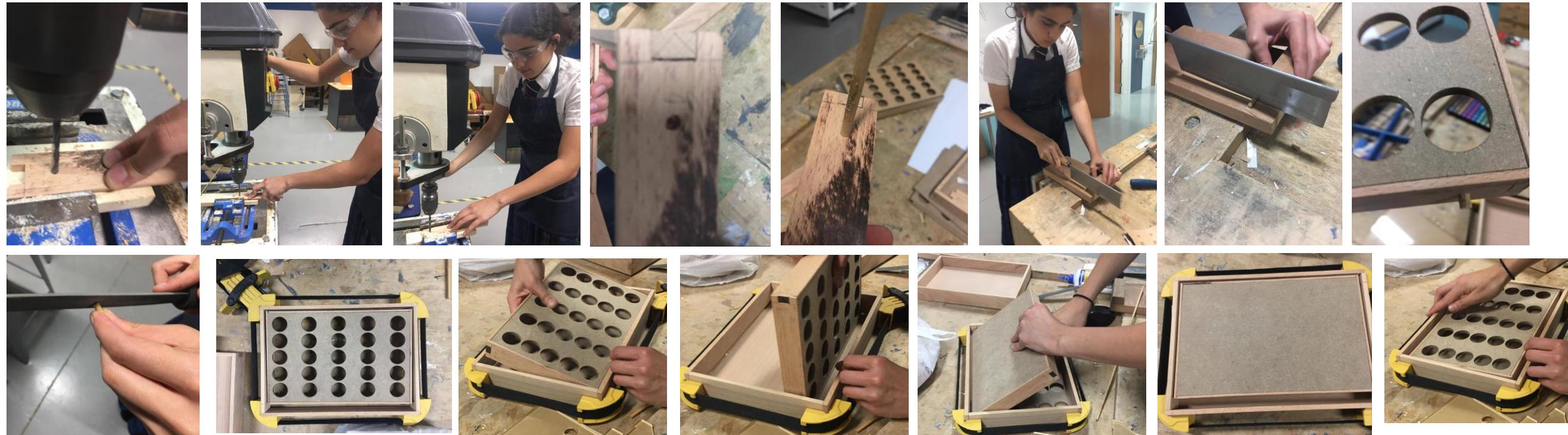


# Manufacture:

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step	process's	Machinery and tools	Safety working practice.
37	<p>With the dowel track now complete, I had to now insert the dowels into the sides of the board. I had to drill a hole into both sides of the board, to ensure the holes were at equal distances on each side and also at the same level of the track I first placed the board sides inside the base and marked a line where the start of the track was on both sides. From that line I then ensure it was in the center of the side, and then ensured it was at the same distance (20mm) above the edge of the board (using a try square to ensure they were at the correct distance and angle). After ensuring that the mark to drill a hole was the same on both sides, I went on to setting up the pillar drill, to do this I (I used a drill of 5mm as the track thickness was 6mm so to avoid tightness I was to use a smaller size dowel.) :</p> <ol style="list-style-type: none"> <li>1. inserted a twist drill (5mm) into the chuck and rotated it until it was secure in place</li> <li>2. I then placed the planks (one at a time) into a machine vice to ensure that my work is secure and wont move while drilling</li> <li>3. I then adjusted the locking lever to a length of (4mm) (as the thickness of the plank was 8mm and I didn't want the hole to drill through the plank)</li> </ol> <p>Once the set up was done I first did a trial test on a waste plank and inserted the dowel into it and after ensuring the measurements were right I went on to repeating the drill onto the marks on both planks, and after drilling I placed the dowel inside to ensure the hole was at the correct size.,.</p>	<ul style="list-style-type: none"> <li>• Steel rule</li> <li>• Try square</li> <li>• Pillar drill</li> <li>• Machine vice</li> <li>• Twist drill</li> </ul>	<ul style="list-style-type: none"> <li>• While using the pillar drill, I ensured to wear safety apron and goggles at all time to ensure no dust flew into my eyes and for overall extra safety</li> <li>• While using the pillar drill, I also ensured to have supervision at all time just incase anything went wrong</li> <li>• By doing a trial test on a waste plank first, it ensured that the set up was correct and safe to use on my actual pieces.</li> </ul>
38	I then had to cut the dowels to the correct length. To get the correct length I added up the deepness of the hole ( 4mm) with the distance between the board and sides (2mm) and the deepness of the track (2mm) which added up to 8 mm. So I cut out two 8mm length dowels and placed them into the holes, before finalizing the measurements I ran it through the board, the dowels then needed to be sanded down to remove splits from the saw.	<ul style="list-style-type: none"> <li>• Bench hook</li> <li>• Gentlemen saw</li> <li>• File</li> <li>• Steel rule</li> </ul>	<ul style="list-style-type: none"> <li>• Using a bench hook while cutting the length of the dowel ensured that I wasn't going to be cutting through the table.</li> <li>• While cutting the dowels I ensured that</li> </ul>
39	Before finalizing the dowels and sticking them down, I clamped the sides of the board and the base together with the board inside the base ( to act as though they are stuck together.) I then ran the board through the track several times to ensure that the measurement was correct, and the dowels ended up being at the right size.	<ul style="list-style-type: none"> <li>• clamp</li> </ul>	

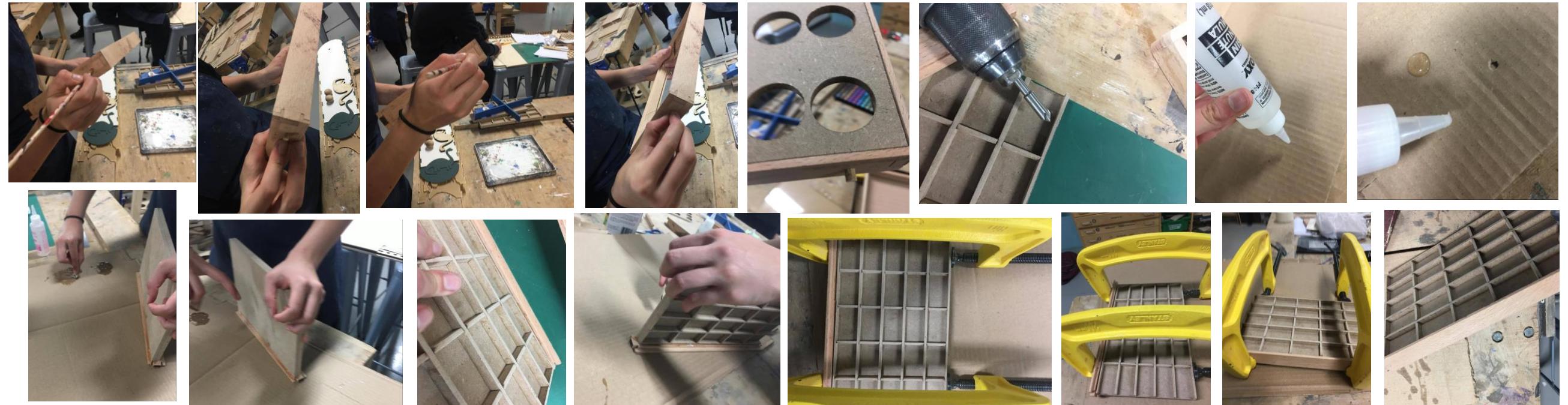


# Manufacture:

\*Times at which developments have taken place will be highlighted\*

Developments taking place will be highlighted in yellow

step	process's	Machinery and tools	Safety working practice.
40	Now that I ensured that the dowels were the correct size and that it ran through the track properly, I added a generous amount of pva wood glue into the drilled hole and stuck the dowels into them.	<ul style="list-style-type: none"> <li>Pva wood glue</li> </ul>	<ul style="list-style-type: none"> <li>While working with the glue I ensured that I had a clear working space so that no glue ended up on other pieces</li> <li>I also ensure to keep an apron on at all times so avoid messing up my uniform</li> <li>I also removed excess glue around the hole once the the dowel was inserted to avoid adding on extra layers to the surface of the wood which make it harder to sand.</li> </ul>
41	<p>While the dowels were drying I moved onto the mechanism of the inner board which would allow it to be pulled out to remove the discs from, in the initial idea for this mechanism the original idea was there would be a chain attached to the sides of the organizing board and a hinge would connect the top piece of the board with the base to allow it to open, however to avoid bulkiness inside the board and potential damage, I decided that I would nail the top of the board to the side of the organizing board. This would make it easier for the children to function and overall a more sensible decision. Although the next idea was to nail the organizing board with the top of fixed board, because I already stuck down the organizing slots earlier (step 16) there wasn't a way that I can fit the drill through the tight slots, so instead I moved onto the next plan which was to use proxy glue to stick the pieces together. ( however if I was to industrially product the product, I would ensure to nail the pieces together before sticking the slots down).</p> <p>I ad to take precautions and work at a fast pace while using proxy glue as it hardens quickly when mixed together. So I first marked out where the organizing board would be stuck to ensure accurate placement of glue. I then placed a small amount of resin and hardener of waste cardboard (away from each other) and once I was ready I mixed both adhesives together with a small waste carboard piece and began spreading it on the designated area, I made sure to only place the glue on that area as if it ended up on other areas it would be hard to sand away. Once I finished applying the glue on the area, I quickly placed the two sides together, then i had to clamp them together to ensure that dried in a fixed position. So I got a classmate to hold them tightly while I clamped the sides together. I then left the sides for an hour to dry even though it only required 15 minutes just to fully ensure that it was ready to continue with.</p>	<ul style="list-style-type: none"> <li>Proxy glue</li> <li>2 clamps</li> <li>Waste cardboard.</li> </ul>	<ul style="list-style-type: none"> <li>I ensured to work at a fast but safe pace when using proxy glue to ensure that it spread evenly and was stuck and dried properly.</li> <li>I ensured to have a clear area to work in to make sure no glue ended up on other pieces</li> <li>I made sure to wear a safety apron at all times to avoid proxy glue ending up on my uniform.</li> <li>I spread the glue onto the sides using used carboard so that it can be disposed safely once used and so that it doesn't end up being used by others wrongly.</li> </ul>

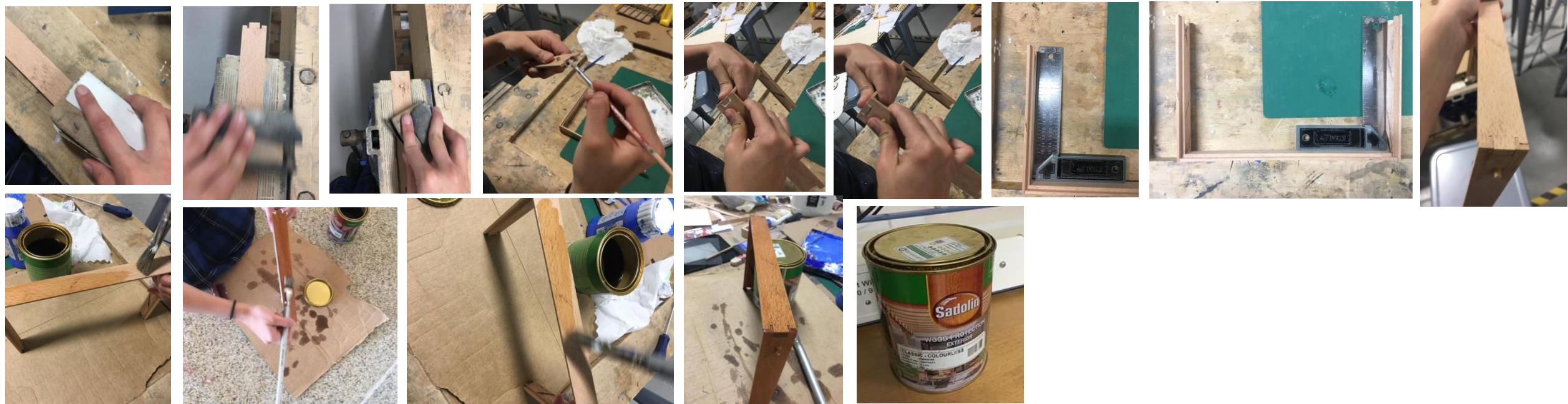


# Manufacture:

\*Times at which developments have taken place will be highlighted\*

Developments taking place will be highlighted in yellow

step	process's	Machinery and tools	Safety working practice.
	In the final design I stated that the whole product would be painted with different colors such as blue purple... but as I came closer to finishing the product I realized that this multicolor design would make the product look <b>tacky and unprofessional</b> and result in a different reaction from the children ( them not wanting to play with the product). So instead of having the whole product in color I decided that only the main pieces will be colored in a set color (blue with white drizzle) and the rest of the product will be covered in clear coat to show off the woods attractive grain.	*Further development*	
42	As the dowels have now dried, I moved onto sanding each of the 3 remaining individual pieces that make up the sides of the board. I placed each piece once at a time into the working vice and sanded them firstly using 60 grit sandpaper then went back over them with p240 smooth sandpaper so that they have a smooth soft finish. I ensured that any visible parts of the pieces were well sanded as they will only be covered in clear coat so any burns will show.	<ul style="list-style-type: none"> <li>• 60 grit sandpaper</li> <li>• P240 sandpaper</li> <li>• Working vice</li> </ul>	<ul style="list-style-type: none"> <li>• I wore a safety apron at all time for extra precautions</li> <li>• Wiped away dust often to prevent build up which can end up in anyone's eyes.</li> </ul>
43	With all the pieces fully sanded I moved on to sticking them together, while doing this I ensured that they were all with the correct finger joint to prevent failure of the board. I used PVA wood glue and placed a generous amount on a paint brush then spread it into the 'gaps' of the finger joints, then fixed them into each other and if there was any excess glue running off the edges I wiped it off with tissue, once the pieces were glued together, I placed them onto a mat with a try square next to their edges to ensure that they dried at a right angle.	<ul style="list-style-type: none"> <li>• PVA wood glue</li> <li>• Paintbrush</li> <li>• 2 try squares</li> </ul>	<ul style="list-style-type: none"> <li>• I ensured that I had a clear working space so that glue doesn't drop on others/my own pieces</li> <li>• Washed hands immediately after finishing using glue to prevent any skin reactions</li> </ul>
44	Once the glue has hardened., I began to set up to begin clear coating them, I set out a cardboard outside away from the work shop as the clear coat has quite a strong smell so any one with allergies can be affected, but in an open environment the smell will diffuse, so I set a cardboard and used a large paintbrush to cover the clear coat on the pieces. I spread even layers on all the pieces, and then turned it around and coated the inside pieces. I made sure to try and not paint on the dowels as that will add an extra thickness to them which may prevent the way the product works. Once I finished coating, I left them outside in a safe corner away from children reach, but also made sure that it was safe from damage and left it there for a few hours so that it can fully dry.	<ul style="list-style-type: none"> <li>• Paintbrush</li> <li>• clearcoat</li> </ul>	<ul style="list-style-type: none"> <li>• Set up to clear coat the pieces outside for others safety as well as my own keeping in mind other allergies with toxic chemicals</li> <li>• Made sure to store the pieces in a safe place to dry away from children's reach for extra safety keeping in mind children wouldn't know what it is.</li> <li>• Made sure to clean up after myself leaving nothing behind as children may end up playing with any left pieces which can lead to severe injuries such as children making contact with the clear coat.</li> </ul>

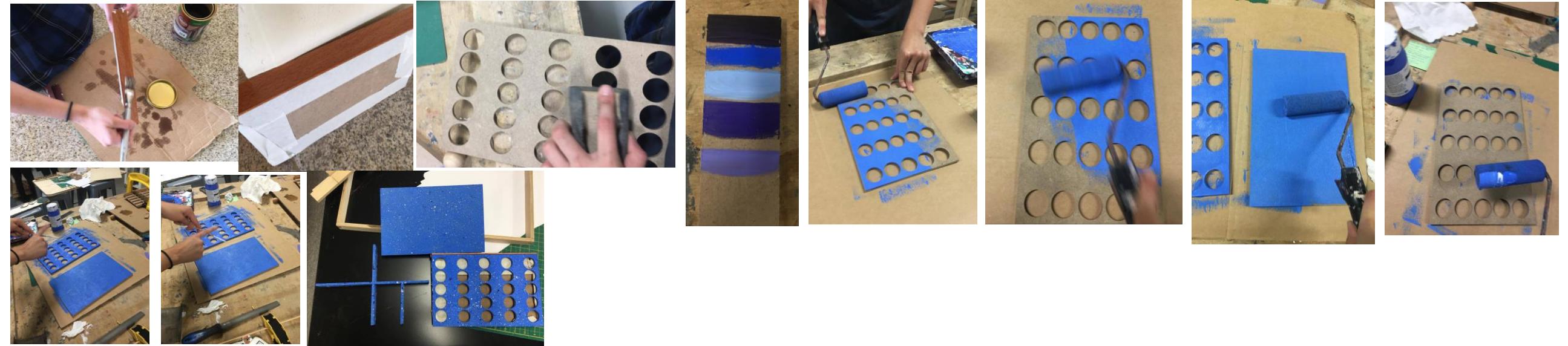


# Manufacture:

\*Times at which developments have taken place will be highlighted\*

Developments taking place will be highlighted in yellow

step	process's	Machinery and tools	Safety working practice.
45	Once the organizing board was fully stuck to the side piece and fully dried, I lightly sanded the board side being to remove any excess glue. I then placed tape around the board and began clear coating the board side so that it matched all the other sides.	<ul style="list-style-type: none"> <li>Clear coat</li> <li>paintbrush</li> </ul>	<ul style="list-style-type: none"> <li>Set up to clear coat the pieces outside for others safety as well as my own keeping in mind other allergies with toxic chemicals</li> <li>Made sure to store the pieces in a safe place to dry away from children's reach for extra safety keeping in mind children wouldn't know what it is.</li> <li>Made sure to clean up after myself leaving nothing behind as children may end up playing with any left pieces which can lead to severe injuries such as children making contact with the clear coat.</li> </ul>
46	Whilst the clear coat was drying, I moved onto painting the board games so that I can finalize the board. I began by really lightly sanding the board games with p240 sandpaper to remove any bumps our scratches that may have been caused during manufacturing, as there wasn't a bump our scratches on the MDF boards it didn't take long. Before moving onto painting I didn't a few paint swatches to decide on which shade of blue to use, I tried out normal purple and blue paint that was provided by the workshop but wasn't satisfied by them as they too dark and so this was against the product specification, so instead i mixed both the colors together and also mixed the blue with white to create a light blue, I ended up really liking the blue, as it wasn't too vibrant nor too dark and so fit the specification well, I first went around the playground to random kids (fair amount in both genders-3 each) and asked them which color from the swatches they likes most, almost all the votes where the light blue shade, so I decided on that.. I then began by painting the board, (I only painted the back of the snakes and ladders game as there was going to be a sticker placed onto the front. I applied a layer of paint then waited for it to dry, then turned over the board ( connect 4) to the other side and painted it. Once the blue coat was fully dry, I decided to spice up the design a little and decided to drizzle the boards with white paint and with dark blue paint to give the design a galaxy effect. I was overall really satisfied with the end result and thought it looked better with the drizzled paint. And all the pieces matched each other giving it an elegant aesthetic.	<ul style="list-style-type: none"> <li>Paintbrush</li> <li>Paint roller</li> <li>Blue, white, purple acrylic paint</li> </ul>	<ul style="list-style-type: none"> <li>While painting I ensured to do it over cardboard so that I don't ruin the tabletops and having the area I was working in covered in cardboard ensured that I wouldn't get paint over other people's pieces or my own.</li> <li>While drizzling the paint onto the boards, I wore safety goggles to ensure no paint splattered into my eyes.</li> <li>I wore safety apron at all time while painting to avoid mess on my uniform</li> </ul>

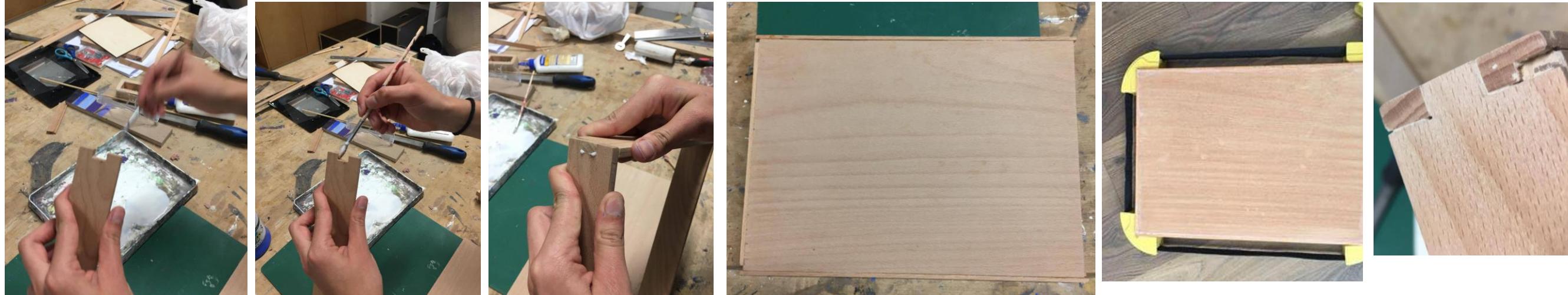


# Manufacture:

\*Times at which developments have taken place will be highlighted\*

Developments taking place will be highlighted in yellow

step	process's	Machinery and tools	Safety working practice.
47	Whilst the board pieces were drying, I moved back to the base. This time on the base I will only be sticking 3 sides together until the board is fully assembled so that it can be inserted inside the base. I started off by sanding all the sides (the base was already sanded previously) with 60 grit sandpaper then p240 to give it a smooth finish. I then began gluing the finger joints together with PVA wood glue, and once I finished sticking the 3 pieces together, I immediately moved onto sticking those sides onto the base. Once they were stuck, I immediately placed them into a clamp to ensure they dried at right angles.	<ul style="list-style-type: none"> <li>Clamp</li> <li>PVA wood glue</li> <li>60 grit sandpaper</li> <li>P240 sandpaper</li> </ul>	<ul style="list-style-type: none"> <li>Whilst gluing I ensured to wear safety apron to prevent uniform becoming dirty from any possible glue leaks</li> <li>I ensured to have a clear working space to prevent messing up other work</li> </ul>
48	Once the second base finished drying, I moved onto wood filling the gaps in the finger joints, as due to rebating the sides it caused there to be really small holes, there was also a very small gap between the base and sides. So I used the wood filler putty and placed small amounts at a time onto a small plank of wood and placed it onto scrap cardboard, to activate the putty there was a red pigment that I added to it, I then mixed them together and immediately added them to the holes, I worked at a fast pace as the putty tended to dry quickly, I repeated this process on both bases, the holes were not that big so this process was fast. I then left boards to dry with the wood fill for 30 minutes as that was the required time.	<ul style="list-style-type: none"> <li>Wood fill</li> <li>Small wood plank</li> <li>Waste cardboard</li> </ul>	<ul style="list-style-type: none"> <li>I ensured to place small amounts of wood fill to use at a time as it dries very quickly and can lead to wastage</li> <li>Once I finished using wood fill I immediately washed my hands to prevent drying of wood fill on the skin which can rip skin</li> </ul>
49	When the wood fill fully dried, I then went in with 60 grit sandpaper and re-sanded the boards so that excess wood fill was removed, and so the red pigment of the wood fill faded. Once all excess wood fill was sanded away I then went in with p240 sandpaper so smooth out the surface again	<ul style="list-style-type: none"> <li>60 grit sandpaper</li> <li>P240 sandpaper</li> </ul>	



# Manufacture:

\*Times at which developments have taken place will be highlighted\*

Developments taking place will be highlighted in yellow

step	process's	Machinery and tools	Safety working practice.
50	As the bases were now complete, I moved onto clear coating, I had to clear coat the unstuck piece separately as it will only be stuck on once the board inserted into the base. So I setup like last time (outside) and began clear coating, I ensured to stroke on even coats all around the pieces and made sure that I didn't add too much thickness to the unstuck joints as that will affect how well it fits in with the other sides. Once I finished coating all pieces, I placed them in an area away from children reach, then cleared up after me	<ul style="list-style-type: none"> <li>Paintbrush</li> <li>Clearcoat</li> </ul>	<ul style="list-style-type: none"> <li>Set up to clear coat the pieces outside for others safety as well as my own keeping in mind other allergies with toxic chemicals</li> <li>Made sure to store the pieces in a safe place to dry away from children's reach for extra safety keeping in mind children wouldn't know what it is.</li> <li>Made sure to clean up after myself leaving nothing behind as children may end up playing with any left pieces which can lead to severe injuries such as children making contact with the clear coat.</li> </ul>
51	By now the clear coating of the inner organizing board was complete. So I removed tape around board and placed the tape around the side. I then began painting the same way I did with all other pieces (blue paint with dark blue and white drizzle), however I made sure to be careful while painting and drizzling to ensure no paint drizzled on the clear coated piece. I was very satisfied with the final look; it is childlike but also mature as it isn't very vibrant.	<ul style="list-style-type: none"> <li>Paint roller</li> <li>Paintbrush</li> <li>Acrylic paint</li> </ul>	<ul style="list-style-type: none"> <li>While painting I ensured to do it over cardboard so that I don't ruin the tabletops and having the area I was working in covered in cardboard ensured that I wouldn't get paint over other people's pieces or my own.</li> <li>While drizzling the paint onto the boards, I wore safety goggles to ensure no paint splattered into my eyes.</li> <li>I wore safety apron at all times while painting to avoid mess on my uniform</li> </ul>



# Manufacture:

\*Times at which developments have taken place will be highlighted\*

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step	process's	Machinery and tools	Safety working practice.
52	Once the clear coated pieces/boards complete dried, I moved onto sticking the organizing slots into the board, as that side has not been completely complete. I first placed them inside the box and marked out where exactly there were going to be stuck to ensure they were straight, I used measuring tape for the smaller piece to ensure it was directly in the centre, I then set up my workspace and began gluing, I began by gluing the two joining pieces together, I then applied glue around the parts that were going to be placed on the base, I then glued the final piece the same way, I then used the back of the paintbrush to run around the slots to remove any excess glue. I used a clamp to bring the sides of the board closer to the slots, so they dried stuck together tightly. I was very satisfied with the end results, the contrast between the blue 'childish' design and the elegant clear coat was very aesthetic	<ul style="list-style-type: none"> <li>PVA wood glue</li> <li>clamp</li> </ul>	
53	I then moved onto attempting to stick the board games onto the sides of the board, but once I inserted the organizing board into it, it didn't fit, this was because I painted the sides of the organizing board which was originally a perfect fit, the paint added extra thickness to the organizing board, so to solve this problem I had to sand the side board to remove the thickness of the paint and there would be no paint at all, this wasn't a problem as the sides of the board are rarely visible and didn't affect the way the game was played at all. So I went in with sandpaper and sanding block and sanded the sides completely. I then placed the inner organizing board into the board again, and it fit better and sliding it in and out the board was easier.	<ul style="list-style-type: none"> <li>Sandpaper</li> <li>Sanding bloc</li> </ul>	<ul style="list-style-type: none"> <li>I ensured to work with ease on the sides on the organizing board to make sure nothing broke.</li> <li>I inserted the board into a working vice to make it easier to sand and make sure I was sanding the sides in equal levels.</li> </ul>
54	Once I ensured that the inner organizing board fit right, I moved onto sticking the game boards onto the sides of the boards. To do this I applied glue around the rebate inside the sides then placed the board into it. I did this with both sides, then placed them into a clamp so the pieces dried with a tight fit. I placed the clamp in the centre of the sides, to make sure there was equal tightness in the sides, and not just the bottom/top of the side planks were tight. I was very satisfied with the end results, the contrast between the blue 'childish' design and the elegant clear coat was very aesthetic	<ul style="list-style-type: none"> <li>Clamp</li> <li>PVA wood glue</li> </ul>	

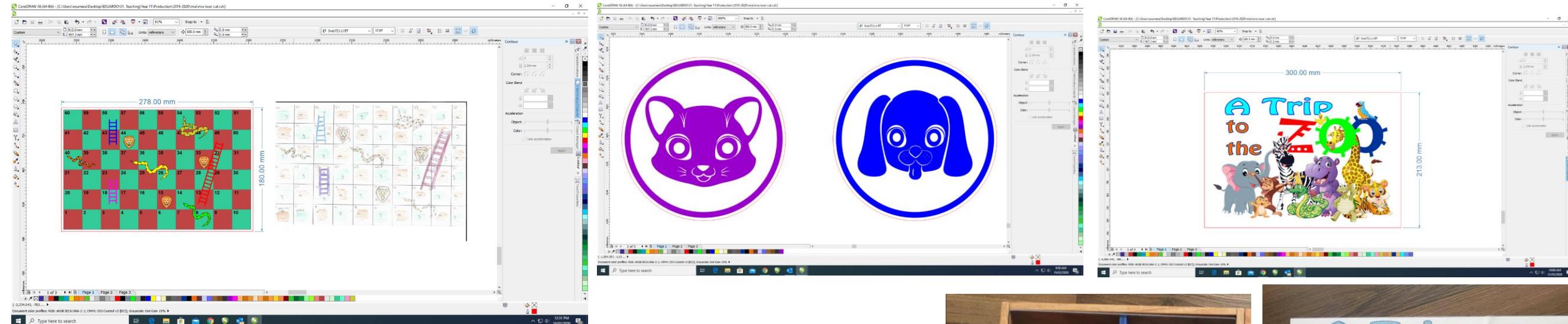


# Manufacture:

\*Times at which developments have taken place will be highlighted\*

Developments taking place will be highlighted in yellow

step	process's	Machinery and tools	Safety working practice.
55	With all the important basics of the product complete, I had to finalise them by making the stickers, to do then I inserted my designs on the computer and began to form them into stickers adding color, for the cat and dog discs I stuck to one color, cats being purple and dogs being blue, to match the color of the titles on the lids. Once I finished making all stickers, they were imprinted onto vinyl sticker, and I stuck the onto that piece of the product.	<ul style="list-style-type: none"> <li>computer</li> </ul>	



## Overall iterations

**Step 2:** there wasn't enough beech material to fit the base of my product, so instead I veneered MDF of the base size using beech veneer, so that the base still maintained the characteristics of beech.

**Step 6:** I was originally going to be using MDF planks for the sides of the board, however MDF tears easily so it wouldn't be able to withstand the joints force, so instead I used beech planks for the sides.

**Step 9:** once I cut out the side planks for the board, a gap was caused due to inaccurate measurements, so I had to re-measure the distance between the planks again, however I only recut out the vertical plank to reduce waste

**Step 13:** once I cut out the finger joints in the side pieces and rebated them, a gap was caused due to the rebate taking off some material, so I had to repeat the joints with a more complex 'I' shape cut to prevent the rebate causing a gap.

**Step 18:** when I moved onto the main boxes, I found that the board was way smaller than box, and this would show too much of the dowels, and will also ruin the aesthetic. So I trimmed down the base of the box, so it was only 2mm bigger than the board on both sides

**Step 32:** I began by spray painting the organizing slots with blue spray paint, however the spray paint ran out early causing patches of different shades of blue, and I was overall unsatisfied with the color, so I sanded off as much spray paint as I can and went in with acrylic paint instead.

**Step 41:** the original plan was to nail the organizing board with the side plank, however the slots were quite small so the drill couldn't fit into the slots to form a nail, so instead I proxy glued both pieces together. However if I was to industrially produce this product, I would make sure to nail the two pieces together before sticking down the slots

**Step 42:** the original idea for the design on the board and bases that it would be painted different colors of those decided on page 16, however I came to the conclusion that this would make the product look tacky and unprofessional, so instead I decided to clear coat all the sides and bases, and the main objectives of the board would be painted (games boards and slots) this would make them stand out more, and overall I was more satisfied with the end result of doing so as I gave the product a more expensive/mature but also childlike look.

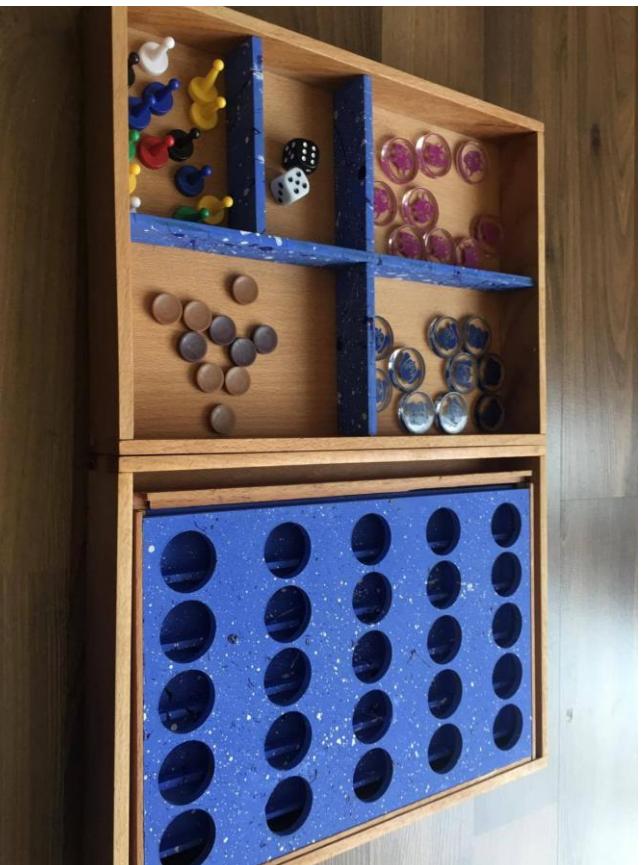
**Step 56:** as I painted all pieces of the board game, including the inner organizing board, it added a thickness to all of the pieces, and this caused a problem of the organizing board not fitting into the board game, so I sanded both sides of the organizing board to remove the thickness of the paint, which meant that the sides would be plain, however this isn't a problem as these sides would rarely be visible. And sanding them allowed the organizing board to fully fit into the board and so fixed the problem.

On this page I will be summarizing all the iterations that have taken place during manufacturing. All iterations that took place during manufacturing where highlighted in yellow. To make it clear where the iterations/developments took place, I will first write down the step that the iteration took place followed by a description to make it easy to locate it.

# Testing and evaluating

- As my school shut down early due to the corona virus outbreak, I was unable to fully complete the product, however, the only thing left to do in my product were the hinges, both for the hinges that connect the two sides together, and the hinges that connect the acrylic lids with the sides for the organizing board, as well as gluing down magnets to the lids to keep them magnetically shut, as these were very small tasks, I have basically completed the whole product, but could not test it due to sides not being joined together, and the schools early leave.

## Final product:



What the product would look like with the acrylic lids

As I didn't have time to make the game pieces such as the dice etc., I had to improvise by using scrap pieces I found from old game I already had.



As stated before, I couldn't fully complete my product due to school's shutdown, so this is the point to what I have reached to.

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