

# Technology Scholarship 2015

## COFFEE TABLE/CHAIR

Modern living Assessment



# Hard Materials-Scholarship

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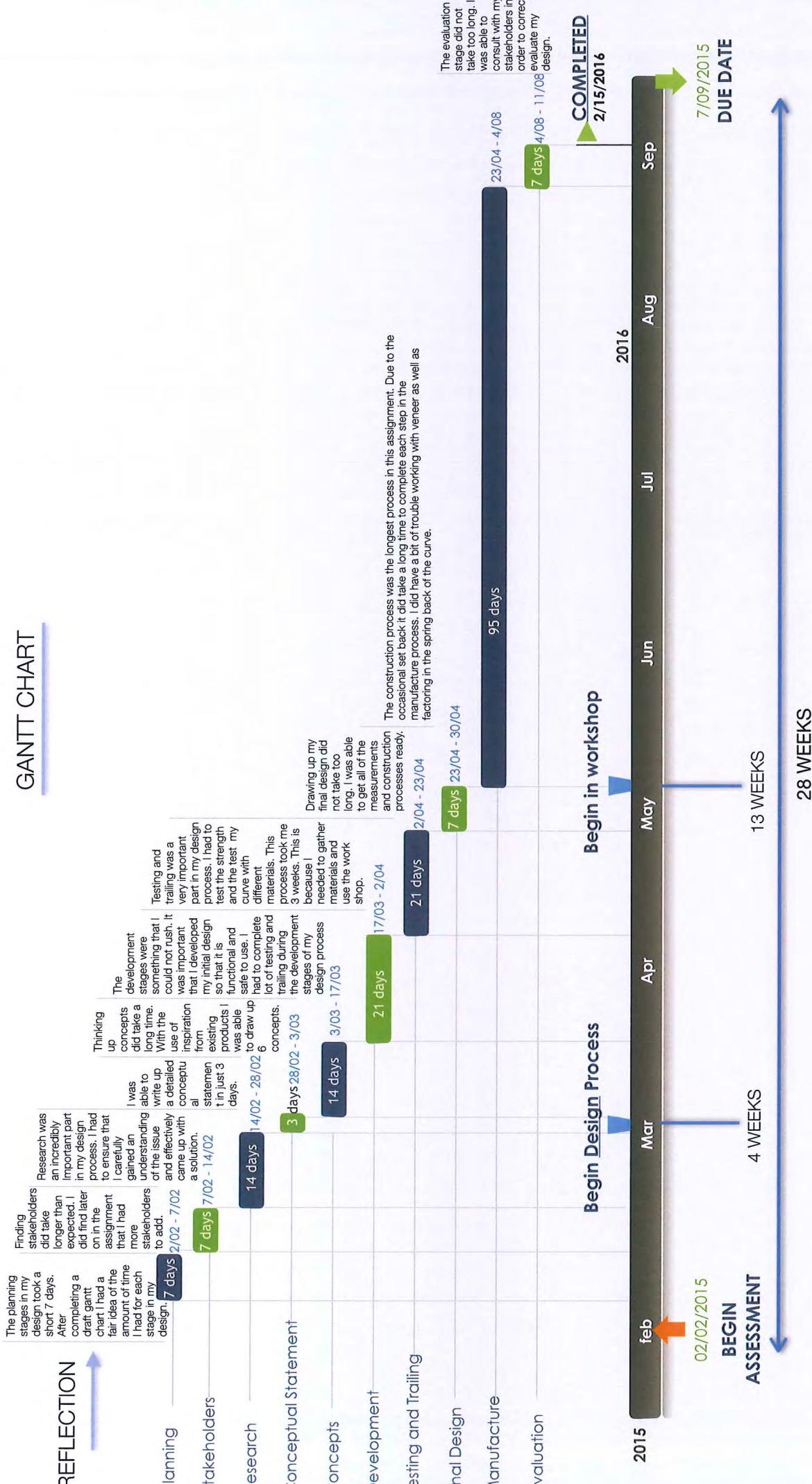
## GANTT CHART

The planning stages in my design took a short 7 days. After completing a draft gantt chart I had a fair idea of the amount of time I had for each stage in my design. I da

REFLECTION

Planning





# BRIEF INTRODUCTION

For hard Materials technology this year, we were given the general context of modern living. After exploring this idea I came up with the two aspects of multi functionality and space saving. This is because these two contexts are becoming increasingly popular in the modern world of innovative design. I began doing some research on these contexts and found that they can be particularly helpful for people living in smaller houses. This is usually; students flatting or large families. With house prices rising constantly it is becoming increasingly harder to afford larger living spaces. A lot of my friends and family have found themselves in the situation where their living space is too small and their home is getting crowded. With the use of multi functional furniture this issue can be solved. This is because instead of having two pieces of furniture and wasting space, these two pieces can be put into one piece of multi functional furniture.

## PLANNING

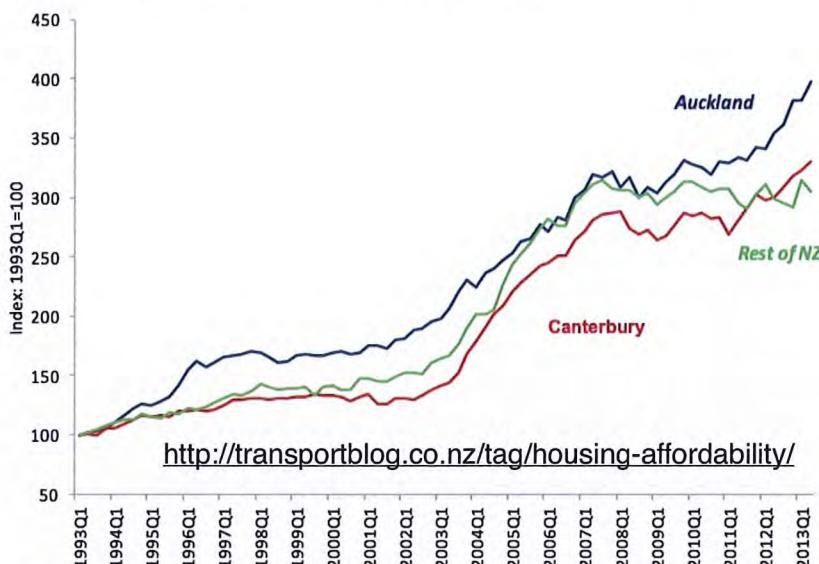
I will need to ensure that I plan out each step in the design process. This means that I will make my best use of time and resources.

- **Gantt chart:** Gantt charts are often used in architectural or construction processes. They give the user a good gauge on the time frame and what is needed to be completed.
- **Issue Identification:** It is important that I gain a good understanding of my chosen issue. I will write a detailed explanation of my issue and solution. To do this effectively I will use references from articles, internet blogs and experts explaining my chosen issue.
- **Stakeholders:** It is important that I find an array of stakeholders. This means I can get valuable feedback by holding regular consultations.
- **Research:** I will need to do some initial search on the issue and contexts. This is an absolutely vital process. This is because it is this initial research that will help me to gain a better understanding of what the product will need to include. I can look at existing products as well as online forums and articles.
- **Conceptual statement:** A clear statement explaining my issue, solution and specifications. Gives me a clear idea of what I am designing
- **Concepts:** I will need to come up with a minimum of 5 initial concepts. Each of these will need to be within my context and working to solve my problem. I will provide some information on my thought process and what each sketch is. It is important that I arrange a consultation with my stakeholders regarding each of the concepts.
- **Chosen design:** I will need to provide justification of my chosen design backed up with stakeholder feedback.
- **Development:** Development is a very important part of the design process. I will need to develop my design so that it is functional as well as aesthetically pleasing. I will also need to consider safety, cultural sensitivity, sustainability and longevity of my design.
- **Tests and Trials:** There are many procedures that I will need to test before applying directly to my design. I will conduct some tests regarding safety, strength etc..
- **Mechanical Drawings:** Creating some scale, mechanical drawings will mean that stakeholders will be able to get an understanding of how the design will look. When buying equipment I can explain what I need by showing the drawings.

● **Construction process:** I will create a log of each step in the construction process. This will mean that the design can be re created by simply following the steps. I will write down what worked well and what didn't.

● **Evaluation:** A detailed explanation of how my product has solved my initial issue. What procedures worked well and what didn't. Including some stakeholder feedback on the final prototype.

# ISSUE IDENTIFICATION



In 2015 house prices are rising vastly. This is causing students and first time home owners to be buying smaller houses and apartments where people are flatting or living with roommates. After conducting some research on this issue I have found that according to statistical data; house prices in Auckland have never been this high before. [mbe.govt.nz](#) says;

*"Real house prices almost doubled between 2001 and 2007, an average increase of 12% per year".*

This makes it increasingly hard for the younger generation to afford a place to live. A large home is not only expensive to purchase but expensive to live in with heating and power bills. Thus causing first time home buyers to go for smaller areas and in some cases to be flatting. This results in a lack of room for furniture and living space. After conducting a survey with survey monkey I found that 5 in 13 New Zealand Families have extra furniture that needs to be put into paid storage. [scoop.co.nz](#) says; *"With the number of Auckland apartments set to rise from 26,500 to 32,000 by 2018, and the average asking price for an Auckland apartment crossing the half-million dollar mark (Trade Me Property figures), more people will live in smaller homes, with less storage space."*

This means that more New Zealanders will be putting their extra furniture into paid storage. This extra money put into storage systems can be saved with the use of new innovative and multi functional furniture.

Smaller homes are resulting in extensive clutter. This is bad for the brain and can cause, stress, anxiety and even mild depression. This can have an effect on study and your working environment. Below is a list of the negative effects caused by clutter in a smaller home. (sourced from <http://paruresishelp.com/clutter-bad-health/>)

#### Effects on Physical Health

- "Exacerbates allergies by inviting buildup of dust mites, dander, mould and other allergens"
- "Creates a germ haven"
- "Increases risk of fire and injuries with the things like the bowling ball rolling off the shelf"
- "Decreases odds of exercise (How can you go running when you can't find your shoes?)"
- "Makes you late for work and appointments when you can't find things"
- "Makes you over weight, with organisational expert Peter Walsh finding a link between over-consumption of stuff and over-consumption of food"
- "Depletes your energy with its overwhelming presence."

#### Effects on Mental Health

- Increases stress and anxiety
- Exacerbates symptoms of paruresis and other mental issues

- Blocks out new things from entering your life
- Strengthens procrastination
- Weakens decision-making skills, as you're avoiding any decisions by letting all this stuff pile up
- Prevents living in the moment

Looking at an article from "Point life" Magazine (issue 4) about people beginning to buy smaller houses and downsizing their living area I have found some interesting information. *"What we are starting to see now is that people are getting wise to the cost and hassle of buying big and starting to buy only what they use".*

As said in the article house prices are beginning to become an issue and this is causing people do start buying smaller houses. Although people with a higher income are managing with the market, students and first time home owners are having to go to the other extreme and buy smaller houses.

# SOLUTION

As a solution to this growing issue I have decided to use "Multi-functionality" and "space saving" as starting points to design a piece of furniture that will work to create more space in a smaller home. I will need to begin by researching existing products and gaining a better understanding of multi functionality and space saving in furniture design. I will need to follow a detailed process to successfully design my prototype. This will involve concepts, development and extensive research.

Information sourced from:

[https://www.reinz.co.nz/shadomx/apps/fms/fmsdownload.cfm?file\\_uuid=F3EBCFA2-D7C6-447B-8971-2255753849DE&siteName=reinz](https://www.reinz.co.nz/shadomx/apps/fms/fmsdownload.cfm?file_uuid=F3EBCFA2-D7C6-447B-8971-2255753849DE&siteName=reinz)

<http://www.mbie.govt.nz/what-we-do/housing/housing-key-facts>

<http://www.scoop.co.nz/stories/BU1509/S00343/valet-self-storage-sights-up-auckland-apartment-living.htm>

# INITIAL RESEARCH

## REINZ Housing Price Index - New Zealand



## CLOSER LOOK INTO THE CONTEXT...

Multi functional furniture:

Multi functional furniture has been around for a long time. Designs such as the murphy bed and the fold out couch are incredibly common in 2015. This is because they save space as well and hold dual uses. I would like to design a piece of furniture that will work to create extra space in the living area. I will need to do some research on existing products to gather information.

Space Saving:

Since the beginning of time humans have been trying to make the space around them as effective as possible. An example of this is the "Portable globe house" designed in 1961. A round shaped miniature house that can be portable by boat, helicopter or truck. This house was designed as a sustainable and affordable alternative to a regular home. As seen in the article to the right this design was merely larger than a car however contained all the necessities of a normal house; bed kitchen, bathroom. The globe house is not being used today however we see similar designs such as "container houses" which have evolved from these early designs. Designs will continue to evolve into the future as

humans continue to search for a sustainable and affordable living area. This is an example of one of the earliest innovative space saving designs recorded in history.



<http://blog.modernmechanix.com/portable-globe-house-for-well-rounded-living/>

Another ancient design used to save space is the infamous Murphy bed. Designed by William Lawrence Murphy in 1900. The murphy bed is designed to be hidden in the wall until it is needed. The Murphy bed was the first piece of furniture to really spike the interest of people in the world of space saving furniture. It slowly became a global phenomenon and today is still being sold in modern high tech furniture stores.

The murphy bed works to control use of space as it can be hidden during the day hours when it is not needed. Similar space saving designs involving sleeping arrangements are bunk beds, fold out couch and the slide out bed.



<http://diycozyhome.com/sofa-bunk-bed/>



<http://www.interiordesignshrink.com/blogs/living-large-in-a-small-space/>

According to the diagram on the top left (data gathered by "Reinz New Zealand") house prices in 2015 are at an all time high. From looking at the data I can see a noticeable increase in house prices in 2007. This will be due to the global financial crisis causing the price of houses to rise dramatically. This increase of prices in 2015 is causing students and first time home owners to be buying smaller houses and even flatting. This is resulting in a lack of living space. Although this is something that is being addressed in 2015 this is a problem that has been going on for a while. As seen below; in 1961 the "Portable Globe House" was designed. This was created in the efforts to sell a more affordable living option. This proves that house prices and living spaces has been something that people have been trying to address for a long time. As people are selling and moving into smaller homes they are having to pay for storage to hold into their extra belongings that don't fit into their new homes. A potential solution for this growing problem is to faze in multi functional furniture.

## INITIAL RESEARCH CONTINUED...

After researching the relationship between house prices and house sizes I do believe that multi functional furniture will help people living in smaller spaces. Many designers are beginning to come forward with new innovative products designed solely for space saving purposes. An example of a company that is striving for innovative evolution in furniture design is "Resource furniture" ("space reinvented") - <http://resourcefurniture.com>. Resource furniture works to create products that will help to better the living environment for people living in smaller spaces. They also strongly believe in sustainability and a healthy planet. All of their products are able to be recycled. It is said that a smaller home is a lot more energy efficient. This is why they are so passionate about making a smaller living space more attractive to home owners.

*"Living in smaller - and most importantly - more efficient spaces while also constructing smaller and more energy efficient buildings is the cheapest and most economical way to make a dent in greenhouse gas emissions." - Resource furniture.*

From looking further into resource furniture and their motives to try and make smaller living areas more attractive; I have learnt a lot. Resource further explains that by cutting down on living space you are using a lot less energy and having less of a negative impact on the environment. By producing sustainable and multi functional furniture we are not only helping those living in smaller houses but decreasing the carbon footprint. This goes to show how living in a smaller home is not all negative. There are many great advantages, such as a smaller power bill, less space to heat and obviously less space to clean. After reading an article from *Point life magazine* I found that this idea is currently being explored, found in an article called "Right size your home",

*"What we are starting to see now is that people are getting wise to the cost and hassle of buying big, and starting to buy only what they use."*

Point life magazine then went on to say...

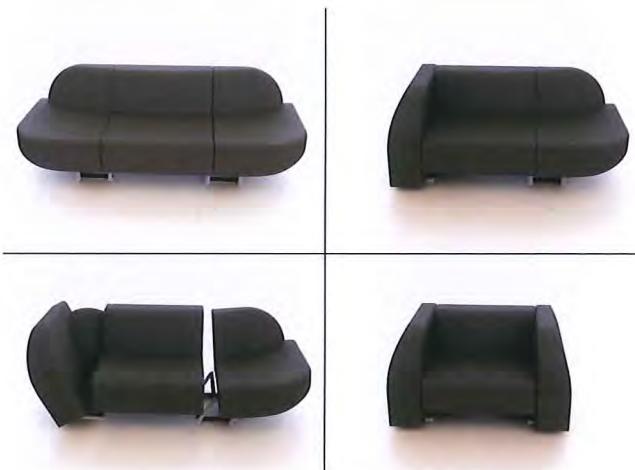
*"How much space do you pay to own, maintain, heat and insure that you use only infrequently? And would owning less land, a smaller home, and less of the stuff that goes in a home, free you up to spend more time and money on the things that you enjoy and love?"*

This explains the idea that downsizing your house is not only financially beneficial but environmentally viable.

Dutch designer Roel Verhagen Kaptein said;

*"Why have three pieces when you can just have one?"*

Roel is particularly famous for his Multi functional design work.



<http://www.coroflot.com/roelverhagen/random>

This piece by Roel is called "Random". Designed to swiftly take on 3 forms with ease. This design would be particularly helpful in a smaller home. This is because it can be transformed to take up less space.

*A solution for when living space is limited and used for different purposes. In everyday use, it is a single seat chair, taking up not too much space. The folding movement is easy and self-locking. With one side folded up it can be used as a chaise longue, and when you have a party, you can turn it into a three seat sofa."* <http://www.coroflot.com/roelverhagen/random>

# SPACE SAVING & MULTI FUNCTIONALITY

I will be designing my product with two main contexts. I have chosen to use space saving and multi functionality. This is because for our school assignment we were given the general idea of modern living and I felt as though these two contexts came under the same umbrella nicely. Each context works hand in hand to save space in a smaller living environment.

Space saving: means a design that is minimal and only includes essential features. Space saving in furniture design started becoming popular in the modernism movement of the 21st century. According to [wisegeek.com...](http://wisegeek.com...)

*"Furniture designed for space saving can be used in a number of different applications. Some pieces even come on wheels so that they can be rolled up and stored out of the way when not in use. It is even possible to get sinks, complete with counter tops, that are like this. However, most space saving furniture is more traditional in its design."*

*In the office environment, one of the keys to space saving furniture is its modular design. Just like a jigsaw puzzle fits tightly together, modular furniture helps make the most of an area by fitting it neatly together with other pieces. While it may not be possible to make every piece of furniture fit exactly perfect, the space savings that come along with such a design are significant."*

I have found this information about modular furniture practically interesting. The idea that one piece of furniture can be broken apart to serve different uses would be particularly helpful in terms of space saving in communal areas such as flats, hostels and dormitories. Although it is said that space saving furniture requires a lot of technical fold down and pull out mechanisms space saving products don't always have to be technical. A simple design such as a table and chairs which fold away smartly also conveys the ideas of space saving in furniture design.

Multi Functionality: Multi functionality in furniture design means that one piece of furniture can carry out the functionalities of more than one item. Whilst researching and analysing this context I came across a report written by Farah Nasser called; "MULTIFUNCTIONAL FURNITURE FOR UNDERPRIVILEGED COMMUNITIES: A MILESTONE IN SUSTAINABLE DEVELOPMENT"-<http://docs.lib.psu.edu/cgi/viewcontent.cgi?article=1027&context=cgttheses>

In this report he talks about the poverty stricken countries that can't afford to get an education and are unable to learn how to build and follow the instructions of preparing furniture. Farah believes that the over crowded living environment in third world countries are a contributor to the poverty and an ideal living environment. I found this interesting as it related to my study regarding the lack of space in common households today due to the rise of house prices. This made me realise that this issue is something that designers are beginning to try and address and notice. Farah explains that third world countries do not have the materials or resources to create new multi functional furniture for their over crowded living areas. By designing sustainable and affordable multi functional furniture that can be put together and constructed at home, this will teach them skills and provide them with new work. I found this idea interesting that not all furniture needs to be sold and bought whole. Some designs can be put together by the consumer. Below I have filled out two PMI charts on each chosen context.

## SPACE SAVING

P	M	I
A space saving design works to create space in its chosen environment. Available space must be researched and analysed. Minimising physical features on the design until it consists of only the bare essentials.	Constructing a design that is made to be folded down or taken apart requires a lot of careful planning and developing. All measurements need to be exact and all aspects need to function safely and correctly	Trying to find ways to minimise features on the design so that it is only the bare essentials. However still keep the functionality of the design.

## MULTI FUNCTIONALITY

P	M	I
Something that is becoming common in modern households. This idea is being explored a lot by designers in the 21st century. There is a lot of existing products that I can analyse and study	Be careful not to combine two pieces of furniture that will need to be used at one given time.	Looking into the history of multi functional furniture. Designing concepts and interviewing stakeholders on what two pieces of furniture will not get used at the exact same time however will get used often.

# STAKEHOLDERS

Who is my target audience? Who is it that is ultimately getting effected by rising house prices in New Zealand?

## STAKEHOLDERS

First time home owners- There is a certain criteria to be eligible to buy a home in New Zealand. These include; you must be over 18, New Zealand citizen or permanent resident, be planning to live in it for 3 years whilst not use it for investment purposes and have a gross income of 53,000 or less for one buyer earn in the last 12 months.

As house prices are on the rise it is getting harder for the latest generation to afford larger homes. Many young families are finding that their living space is not large enough to comfortably fit their growing families. Use of new innovative multi functional furniture will work to solve this problem.

Students (Flatting or renting)- Often students and young people are known to flat in groups. Although this is financially beneficial it can often mean that their living space is cluttered. With use of multi functional furniture these living areas can be de cluttered and still contain the same pieces of furniture. I have conducted an interview with a group of students who flat together in a 2 bedroom house. This living situation is becoming increasingly popular with the cost of education rising as well as the cost of house prices.

## STAKEHOLDER CONSULTATION

I have conducted an interview with Cameron Tulett. A university student flatting with 5 people in a small compact four bedroom house.

What is your main issue with living in a shared and compact living area? "*I can never fit all of my clothes in my drawers, we seem to have absolutely no living space*".

If you had a more organised storage system would you have enough space for all your items?"*Yes I think so, we have a lot of unused space on the ceiling. Maybe finding a way to utilise that space would be helpful*"

## GENERAL STAKEHOLDERS

People living in smaller living areas- Overall small living areas are becoming increasingly popular in 2015. This is not only because of the rise of house prices but because it is actually a lot more environmentally friendly to live in a smaller home.

I have conducted an interview with Calla Dimaya a student from Westlake, living in a 2 bedroom house with a family of 4.

What is your main issue with living in a smaller living space and sharing a bedroom? "*Definitely the lack of storage space. It seems we have too much furniture and not enough space*:

Have you resorted to any paid storage companies? where do you store your extra items? "*We have to store all of our extra stuff in the garage. This is very inconvenient*"

Physics teacher- My heatoandra can provide me with advice on physics properties involved with my design. This includes important formulas which can help me during the testing and trailing processes in my design. I can go to my physics teacher for advice on potential developments to make my design more functional.

Sewing teacher- Miss Luisetti can give me advice on processes associated with the sewing department. This may include anything from packaging of my design to design aspects such as a cushion or squab.

Maori teacher- Can give me valuable advice on what is ethical. Cultural sensitivity is becoming increasingly important in 2015. Seeing my intended market is very broad I must ensure that I cater of all cultures when designing my product.

## WIDER COMMUNITY STAKEHOLDERS

Companies- I will be contacting furniture companies such as in "habitat" and "home-edit" who deal with multi functional and space saving products. These companies will be able to give me further insight into the world of multi functionality and what key characteristics make up a multi functional piece. I will be able to gather inspiration from existing products as well as look at how they are made and what is required for a multi functional piece.



<http://inhabitat.com/seung-yong-songs-multi-tasking-chair-lets-you-hide-store-and-even-dry-your-clothes-while-you-sit/>

Survey Monkey Respondents- I will be using an anonymous survey to get a better understanding of how common multi functional furniture is in the common household. This will help me to understand if there is in fact a link between multi functional furniture and smaller spaces. These responses will also help me to have a gauge on how the market is effecting house sizes.



# EXISTING PRODUCTS/ RESEARCH

By looking at existing products I can gain a better understanding of multi functionality and space saving. I will be able to look at the way multi functional products have been developed over time and what issues can come along with multi functional and space saving products. A famous piece of space saving furniture that has been around for over 100 years is the Murphy bed. The murphy bed was designed in 1900 by William L. Murphy...



as seen in the diagram above the Murphy bed was originally made with heavy steel framing. It was ideal for space saving purposes. Through out the last 100 years the murphy has been developed to be even more effective and innovative. Although this product has many advantages it also has a couple disadvantages. This bed has resulted in multiple accidents including even death. This is due to a defect in the gas piston where the bed has snapped up while the occupant is inside.

Another famous space saving design is the classic fold up table. Fold up tables are usually used in schools and public places. It is common that out door furniture is able to be folded up. Fold up furniture is often made with light weight materials to increase portability. There are many advantages with fold up furniture. Not only is it easy to move and transport but it can be neatly stacked away and stored. Often items such as the ironing board are able to be folded down with the same mechanism. There are few disadvantages with fold up furniture. However occasionally they can be hazardous when used incorrectly.

The photo below shows the common classic fold down table. The history of the fold down table originates from the ancient Egyptian times, at the time it was an expensive item but after the industrial revolution it became increasingly popular and started getting sold in bulk. An advantage to this



classic wooden fold down furniture is it is very sustainable and able to be recycled with ease. In this modern era sustainability in furniture is becoming increasingly popular amongst designers.



Fold down furniture is particularly popular in the world of space saving furniture. however some space saving items have been designed with a different approach...

An idea that is recently being explored in the world of space saving and multi functional furniture is this idea of multi functional shapes.

As seen in the picture above the design is able to be used as an entirely different product by simply changing its position. This is because it has been carefully designed to fit multiple purposes without any springs or levers. This style of furniture is becoming

increasingly popular in the modern era. This is something I could potentially explore in my concepts. A design which I found particularly interesting when looking at multi functional and space saving products was this bed/ couch; This is an extremely modern



approach to the classic "fold out couch". The interesting aspect of this design is the way it can be transformed into bunk beds. Bunk beds have been around since the late Egyptian times. They then began extremely popular in hostile and camps across Europe. This is because of their ability to save space in a restricted area. This shows the way this design shows attributes from both a "multi functionality" and "space saving" stand points. Although this design is not particularly sustainable, it is well made. This means it will have a long life cycle and will not be an item that is thrown away after a short amount of time. This is something that I will need to take into consideration when designing my product. Something that I noticed when researching these multi functional designs was that safety is often a problem. This is because springs and levers are used to transform the item into a new piece of furniture. If not made correctly this can malfunction and cause an accident. I will need to ensure that my design has been tested and can be deemed safe to use.

Sources: <http://murphybedcompany.tripod.com>  
<http://seekayem.com/multi-function-furniture-design-small-house/computer-table-transform-to-bookshelf-and-study-desk-multifunction/>  
<http://theredbootquiltcompany.blogspot.co.nz/2015/06/small-folding-table.html>  
<http://www.treehugger.com/htgg/how-to-go-green-furniture.html>

# IMPORTANT ATTRIBUTES/CONSIDERATIONS

Even after interviewing my stakeholders and researching my issue I have found that there is extra attributes that I will need to consider throughout the design process; I have prioritised these from low-high  
**KEY: PRIORITIZING**

 HIGH

 MEDIUM

 LOW

**STRENGTH/SAFETY:** It is important that my design is strong and safe to use. Although my product is just a prototype, if it was to be made in bulk it is important that it has been designed for a wide range of consumers. This means that it must be strong enough and durable enough for any household situation. I will need to conduct some testing and trialing regarding the strength of my product

**FUNCTIONALITY OF MY PRODUCT:** I will need to conduct some research on the functionality of my prototype. A lot of multi functional furniture has been engineered so that it can be transformed/broken down. I will most likely be needing to do something like this for my design. I can look at joins and hinges from different stores such as mitre 10 and Bunnings. These places might have equipment that is ideal for my design.

**STAKEHOLDER FEEDBACK:** I will need to hold regular consultations with stakeholders to that I am aware of what my stakeholders are looking for in my product. It is important that I gather information from my stakeholders about their living environment so that I can cater for them. This will also include research, statistics and surveys to gather further information.

**MATERIALS:** I will have to purchase most of materials through the school. If the school can not provide any materials I will go and buy my own. I will need to conduct some testing and trialing to find what materials would be most effective for my design. It is important that my materials are functional as well as aesthetically appealing.

**AESTHETICS:** My design is intended for a very large audience of consumers. I will need to design something modern and appealing while adapting for a wider range of tastes.

**ENVIRONMENT:** I will need to consider the environment that my design will be used in. My design is intended for people living in smaller spaces. Research and stakeholder feedback will help me to cater for this cause.

**TIME FRAME:** I have a time frame of 28 weeks to complete this assignment to the best of my ability. I have created a plan and a gantt chart with evenly distributes my time for each stage in the process of this design.

**BUDGET:** The school covers \$50 of the materials costs. I will need to pay the rest. I am setting myself with a budget of \$150.

**WEIGHT/TRANSPORTABLE:** A good design is something that can easily be transportable. This is because often people will move houses or even move around the layout of their living areas. According to <http://fivethirtyeight.com/datalab/how-many-times-the-average-person-moves/> the average person will move 11 times in their lifetime

**CULTURAL SENSITIVITY:** Because my design is catered for a generalised audience "people living in smaller and cluttered living spaces". I will need to keep in mind that many different cultures could be using my design. This means I will need to ensure my design is culturally sensitive.

**AVAILABLE RESOURCES AND EQUIPMENT:** The school resources are limited. I should be able to complete the majority of my assignment using equipment from school. However there may be the occasional time where I will need to seek professional help.

**ERGONOMICS:** The ergonomics of my design are moderately important. I will need to make sure that it is user friendly and will not cause any harm to the consumer.

**LONGEVITY:** A good design lasts long. This means I will need to take my time when constructing my design and ensure I carry out processes that will help bring longevity to the design. For example using a varnish over the finished product will mean it will be resistant to spills and potential scratches.

**SUSTAINABILITY:** Sustainability in design is becoming increasingly important in this throw away society. I will try to create a design out of mainly natural resources. I believe that the longer the product lasts the more sustainable as it will not be thrown away immediately.  
*"Design to use as few resources as possible. But also, does your product fit in with the environment it will be in?"*

<http://todaymade.com/blog/good-design/>

**MULTI FUNCTIONALITY:** It is particularly important that my design is innovative and adaptive. This is crucial as it is imperative in my brief.

**SIMPLE:** It is important that my design does not add a cluttered feel to a smaller home. It must be simple yet useful. According to Dieter Rams and his principals of a good design,  
*"A good design is as little design as possible".*

<http://todaymade.com/blog/good-design/>

# INITIAL BRIEF

After completing some initial research on the issue of "small living spaces" I have found that this is an incredibly common issue that a lot of people are dealing with. I have done some research on the link between house prices and small living spaces. This has taught me a lot about the way the market is working and what people are tending to buy.

I have also conducted a quick survey which gave me insight into how common it is for families having to pay for extra storage. This is due to having lack of space and too much furniture after moving houses. I have also found a couple news paper articles on the issue. These articles talk about how a small living space is not all negative. With innovative layout and furniture a small space is actually all that you need. Since the beginning of time designers and architects have been looking for new innovative ways to conserve space. I have looked at some existing products such as the murphy bed, fold out couch and many more. These have given me some valuable insight into existing multi functional furniture. I have also been in touch with some stakeholders who are living in smaller and crowded spaces and what it is that they are looking for in a product. After researching my contexts (space saving and multi functionality) I have a clear understanding of what my concepts must include.

The next step in my design process is to complete some initial concepts where I will be able to choose one to develop further. At this point in the project I do feel I still have a lot of freedom to design different products as long as they are all within the context. I have been able to come up with a list of specifications regarding strength, time, weight, budget etc... (These can be seen on the specifications page).

I will need to come up with a concept that will work within my multi functional and space saving context. By designing a single piece of furniture with the functionality of more than one piece of furniture I am working to save space in a smaller living environment. I must ensure that my design is aesthetically appealing as well as functional. I will need to carry out some testing and trailing during the development stages of my design so that I can be comfortable that it is safe and strong to use. I will need to draw up some detailed mechanical drawings with measurements so that I am able to write up a cutting list with all of the materials that I will need. I will need to consult with stakeholders to ensure that my design is working to solve the issue.

Below I have prioritised factors that are important for when I am sketching my Initial Concepts.

-  HIGH
-  MEDIUM
-  LOW

**IMPORTANT:** I am not designing my product for a specific client. I am designing this for a generalised group of consumers (Students and first time home owners; restricted to buying and living in smaller houses. This is due to the rising of house prices). I do have an array of stakeholders (in this living situation) whom I am gathering facts and information from. I also have sufficient evidence from articles and internet forums backing up my issue. However seeing I am designing this product for "the public" I must make it suitable for an array of cultures and weights/sizes. This means I will need to do some research on ergonomics and cultural sensitivity to ensure that anyone would be happy to use my design. It is also important that my design is self-explanatory and easy to use. Being a multi functional item this may be challenging as generally this means that the user will have to change its form.

-Ensuring that my design is SAFE to use.



-Ensuring that my design is CULTURALLY SENSITIVE.



-Ensuring that my design is FUNCTIONAL



-Ensuring that my design is AESTHETICALLY pleasing.



-Ensuring that my design is SUSTAINABLE and not harmful to the environment.



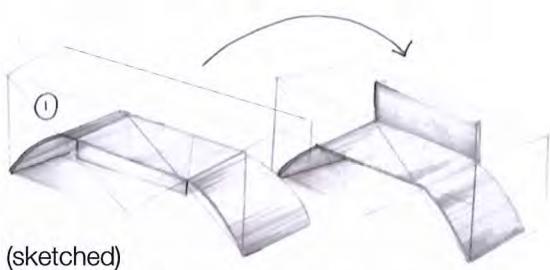
-Ensuring that my design is comfortable and USER FRIENDLY.



-Ensuring that the design is SELF-EXPLANATORY.



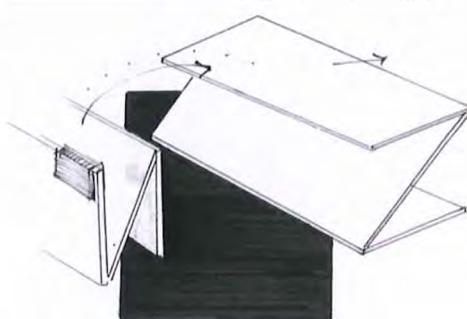
# CONCEPTS



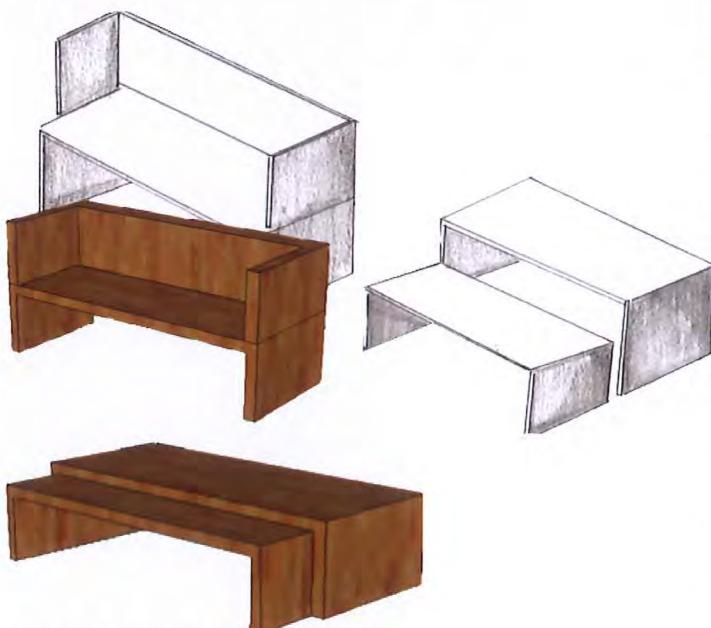
(sketched)

My first concept was a multi functional chair/coffee table. The idea is that the back of the chair flicks up from under neath and changes the products function. This is a design that would need to be developed a lot further to make it functional. I would need to do some further research on the radius of the curve and the strength of the surface area. I think that this concept accurately addresses my issue and would be particularly helpful for someone who commonly has guests over. Not only does this product have the advantage of being multi functional but it also works to save space in smaller living environment. This is because it works as two pieces of furniture in one.

However I feel as though this design needs thorough development. I can potentially add storage systems and some sort of folding down mechanism for easy transportation. I feel as though this product would appeal to children and families with kids. This is because it is simple to use and carries out functions similar to a children's "play-table and chair" set up. In terms of addressing the chosen issue I feel as though this design would work nicely. With a quick and easy rearrangement of pieces it can be transformed into a new piece with a new function.



My next design was inspired by the latest innovation in furniture where a simple rotation of the product changes its function. As seen in the sketch this coffee table also doubles as a magazine and book storage system. The idea is that books and magazines get placed along the edges. This is an effective way to store books as well as keep your place without a bookmark. This design would need a lot of development regarding strength. I feel as though extra storage can potentially be developed into the design too. Perhaps a way to effectively store the item when it is not in use? (pulls apart or folds down?).

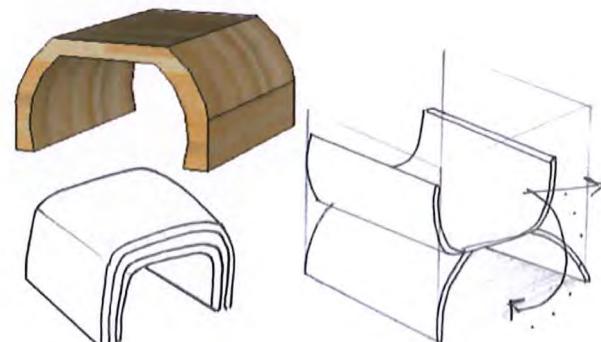


Sketched + computer generated  
(sketch up)

My second concept uses two basic pieces to create 3 different functioning items.

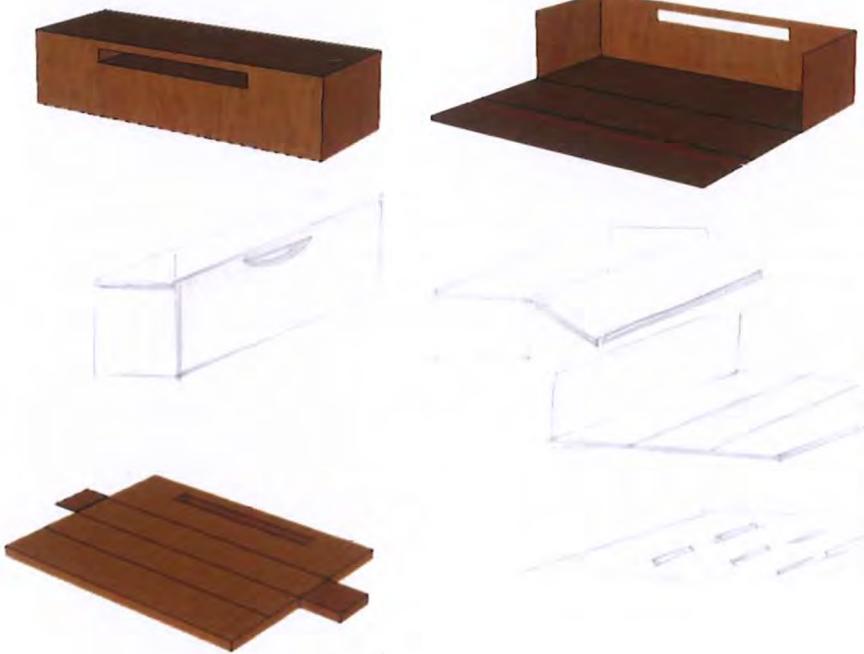
1. Table and chair
2. two seater chair (including back rest)
3. Basic coffee table

With one piece slightly smaller than the other the product can be neatly stored together in a compact space. This product addresses both contexts of multi functionality and Space saving.



My design here is aimed at children or families with children. A quick easy chair/play table system which can be stacked together or pulled apart. With curved edges it would be safe and smooth (suitable for young kids).

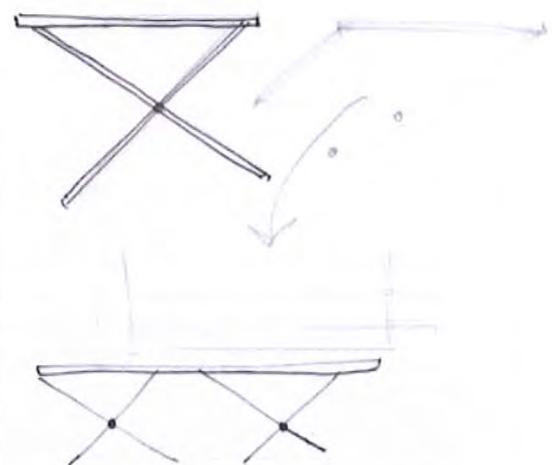
# CONCEPTS



This concept is a product intended for the kitchen. Both a storage box as well as a chopping board. Using magnets on the insides of each panel will mean it can be easily pulled apart or put back together. Although this design is multi functional, I feel it doesn't contribute to the space saving context. This is because this design is more of a product than a piece of furniture. A major flaw that I see in this design is that fact that a chopping board is something that is used very often. This means you would need to empty the box regularly to use it. The only way that this could be useful would be if the box was used to store knives. This way you would be using the knife and chopping board at the same time. Perhaps creating something like a knife holder as seen below;

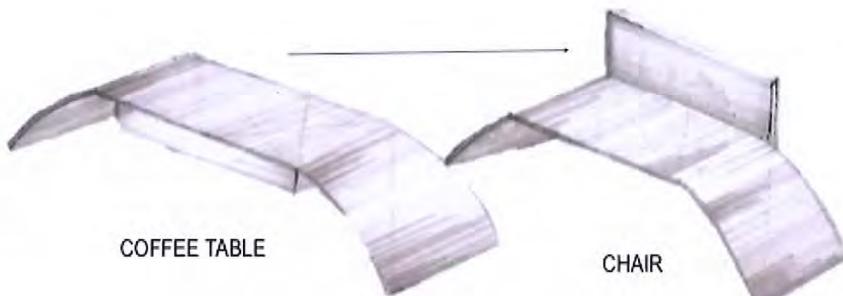


This concept is inspired by the traditional knife holder. (As seen above). However with its ability to be taken apart and transformed into a chopping board it becomes multi functional. Over time chopping boards tend to get damaged with the constant knives and dish washing. I would need to test and trial with different varnishes to find a way to give the design a longer life.



Here I began to play around with the basic fold down table idea. potentially to be extended to be either a larger table or smaller table. With some intense development and research I can design a new innovative way to make the table fold down as well as transformable. This will mean that this design is both multi functional as well as within the space saving context. I will consult with stakeholders to see if this idea is appropriate for the context. I feel as though this is not one of the strongest concepts. Only because their are many similar designs on the market. I want to design something slightly different and innovative.

# CHOSEN DESIGN



## JUSTIFICATION OF CHOSEN DESIGN;

I have been given the general context of "Modern Living". After thoroughly researching this theme and existing products I was able to come up with a variety of initial ideas. Each of my concepts reflect the ideas of multi-functionality and space-saving. After conducting some research I have found that house prices are rising and this is causing students and first time home owners to be living in smaller houses. This means the demand for multi functional furniture is becoming increasingly popular. I have chosen the "coffee table/ two seater chair" design to develop and manufacture. I have chosen this design because it can be developed to correctly fit the brief. Processes in making this design will include working with laminating and application of veneer. These are two particularly challenging processes. I think that this design has potential once it has been developed carefully. I will need to ensure that I develop this design so that it is culturally sensitive, safe/strong to use and appealing aesthetically. To do this efficiently I will need to interview a range of stakeholders. I will also need to ensure my product that can be specifically used for "smaller living areas". I will need to provide a list of specifications that I will need to meet. As well as conducting some testing and trailing regarding materials and strength. It is important that I do some testing requiring strength so that I can be confident that my design is safe to use. Seeing this design is a two seater chair I will need to be confident that it holds at least 100kgs. There are many aspects that make up a good design. I will need to address all these points to ensure I have designed this product to my best ability. Once I have developed and manufactured my design I will write another evaluation addressing all of these important points.

## STAKHOLDER CONSULTATION

- Cameron Tulett (student flatting with 5 people in a limited living space):

Do you often find that you or your flatmates have guests over? if so do you have enough seats for everyone?

*"Yes we often invite friends around and find that seating is an issue. This design would be particularly helpful because it is discreet and helpful as a coffee table and quick and easy to transform into a chair if needed."*

How do you feel I could develop this design to make it more space efficient?

*"Perhaps some form of storage would make the design a lot more helpful. even just for magazines or coasters."*

Do you think this design will help the issue of available space in a crowded living area?

*"Yes, definitely this will mean that we wont have to double up on furniture. instead of owning both a coffee table and a chair we will have both in one piece. This will conserve space and de clutter our flat a lot"*

- Calla Dimaya (Student at Westlake girls high school- family of four-two bedrooms)

Do you have a lot of furniture in your living area? do you find it crowded?

*"Yes, we have 2 couches, a coffee table, and two book cases. It is a lot of furniture for the given area."*

Do you have any extra furniture that doesn't fit into your house?

*"Yes we do have some extra stuff in our garage. Mainly just extra items but furniture wise we have a dresser stored in there."*

Do you often have guests over? if so could this design conserve space and be helpful in your home?

*"We have people over all the time. This design would be very helpful as we never have enough seats."*

# FINAL BRIEF

Now that I have chosen a concept to develop further I am able to make a much more detailed brief. I have chosen the coffee table/chair design.

I liked the idea of adding curves as this is a new and challenging process. I also think that the curved look will help to make this design look modern and aesthetically appealing. I will need a design that will appeal to the younger generation. (People flattening first time home owners). I will need to do some research on the process of LAMINATING curves and what MATERIALS will be most appropriate for this look. It is likely that I will use either bendy ply or MDF to create the curved shape. Neither of these materials are particularly attractive. A solution to this may be coating the design in veneer?

Seeing my design is both a coffee table and a chair I will need to do some development regarding CULTURAL SENSITIVITY. I will be able to get information from stakeholders. By gaining a good understanding of other cultures I will be able to find an effective way to create a culturally sensitive design.

Looking at the chosen concept, it does not look very structurally safe. I will need to do some development regarding STRENGTH. This may mean that I will have to make a replicate of my design and test on it with weights. I will record all of my findings. Having one curve (as seen in concept) does look appealing however will not be functional. I will need to add some more structure to the design.

I will also need to do some development and research on how the design will FUNCTION. How will it turn from a table to a chair? What mechanisms will I use? By looking on the websites of shops like "Bunnings" and "Mitre 10" I will be able to gather some ideas.

## NEXT STEPS IN MY DESIGN PROCESS;

Development- Develop my design so that it meets all of my specifications and attributes.

Final research- Research materials, laminating and any other important construction processes before I move onto construction.

Technical drawings- Gain a good understanding of how my design looks by drawing it to scale in different media. (computer, orthographic). From here I will be able to make a cutting list of exactly the materials I need.

Construction: At this stage I will be ready to begin construction. Creating a log of all my processes will mean that the design can be recreated. I will be able to log what worked well and what didn't.

Evaluation: Write a detailed evaluation about how I have solved my issue by creating a technological outcome. Discuss the things that went well and things that could have been done differently. This is an experimental prototype that is bound to have flaws.

# SPECIFICATIONS/ CONCEPTUAL STATEMENT

After talking to my stakeholders I was able to create a list of specifications.

## 1. My design needs to safely hold at least 100kgs.

Safety will be an important aspect of my design. seeing my design is not only a coffee table but a two seater chair, I will need to ensure that my design can comfortably sit two people. To do this I will need to carry out some testing and trailing regarding the strength of my design.

## 2. Must be useful for two everyday intended purposes. (multi functionality)

This will mean that my design will be the solution to my chosen issue. I must ensure I stay within my content while designing my product.

## 3. Must be culturally sensitive.

Seeing my design is being made for the general audience of students and first time home owners I must cater for a variety of cultures.

## 4. Must be user friendly. (safe)

To do this I will need to carry out some testing and trailing regarding strength, I will also need to ensure that my final product does not have any hazardous or sharp edges.

## 5. I have a time frame of 28 weeks to complete this assessment. Must not exceed this time limit.

This is because I am getting graded for this assignment. The due date for this assignment is the 7/09/2015. If i do exceed this time limit then I will not be awarded a grade.

## 6. Weight of my design must not exceed 40kgs (Transportable)

A design heavier than 40kgs would be particularly hard to transport. It would also be hard move around in the chosen living area. I will try my best to use materials and procedures that create a light and transportable design.

## 7. Must not exceed a budget of \$150

Looking at the materials that I will be using from the workshop my design shouldn't exceed \$150.



Hobsonville point- <http://jalconhomes.co.nz/for-sale/hobsonville-point->

## CONCEPTUAL STATEMENT

*It is a known issue that house prices are on the rise. Particularly in the Auckland region of New Zealand. This is causing students and first time home owners to live in smaller houses as a cheaper alternative. This is resulting in the crowding of furniture and items. Because of this many people are putting extra belongings into paid storage. This is not always ideal for families or groups of students (flatting) because of extra costs. I have decided to combine the contexts of Space saving and Multi functionality to create a piece of furniture that will work to provide extra space in a smaller home . This is because a multi functional piece of furniture will take on two tasks and eliminate a piece of furniture from the chosen environment. I will begin by brainstorming with some initial concepts and gathering some stakeholder feedback. During each stage in my design process I will need to have regular consultations with my stakeholders so that I can create an effective and innovative piece of furniture. Regular feedback will help me to gather an understanding of what people from these living situations are looking for in a piece of furniture.*

# DEVELOPMENT MATERIALS

My chosen design has a curved shape to it. Before developing my design I will need to test and trial with possible materials and curves. This is so I can determine what materials would be more appropriate for my chosen design. I need to be able to determine what shaped curve would be the most functional. I will also need to look at the human body and how ergonomics work in order to figure out sizes. Two materials which would be ideal for my design are MDF and Bendy ply. I have tested my curve which each of these materials to see which material better holds the shape.

I began my testing and trailing with MDF: I began my experiment by carefully creating a mould to bend the wood into my desired shape. I then began to layer pieces of MDF onto the mould with glue in between. Using clamps I then secured the layers into place to dry. Once the curved shape was dried and un clamped I found that it slowly deflected out of shape. This would not be ideal for my design as it is important that the curve stays in its intended shape.



The picture above shows the process of bending the MDF using a mould. At this stage in the design it had been clamped and I was waiting for it to dry. This process had to be repeated with both MDF and bendy ply in order to accurately compare both materials.

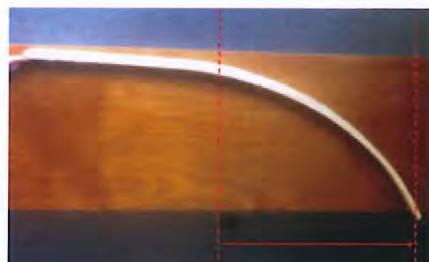
I then went on to complete the same test using bendy ply. Again I used a mould and added layers of bendy ply with glue underneath. I found that once the bendy ply dried it was much more effective than the MDF. It held its shape properly and did not deflect. The comparison in shape is shown below;



As seen in the pictures above; the MDF (right) did not hold its curved shape as well as the Bendy ply (left). This is because MDF is a lot denser and stronger than bendy ply. Bendy ply is designed specifically to bend into curved shapes. I can confirm after this experiment that I will use bendy ply in my design

## RADIUS/SHAPE DEVELOP

Another issue I found during the development stages of my design was that the curve I had created had a very large radius. This means that there is not a lot of usable flat surface area. To fix this I would need to create a tighter and smaller curve. This would mean less of the design is taken up with unusable surface area. The diagram below shows how a tighter curve can save potential flat



As seen in the first curve above there is not a lot of flat surface space. This is because the curve has a large radius. This means that there is not a lot of space that can be used. This is an issue as it contradicts the space saving scenario. I then came up with a second design: In the second diagram I have created a tighter and stronger curve. This would be a lot more effective as it leaves extra FLAT usable surface area. The second diagram has a much smaller radius. I will need to create a new mould so that I can change the shape of the curve for my actual design

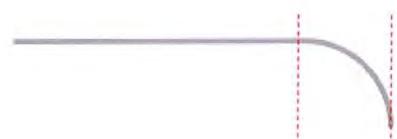
## ALL CHOSEN MATERIALS

**BENDY PLY:** For my main body material I have chosen to use Bendy Ply. Two materials seemed appropriate to work with; bendy ply or MDF. To chose the most appropriate material for my design I conducted a test where I bent each material using the same curved mould. After completing this experiment I found that the MDF sprung back and did not hold its curved shape. This left me with the most flexible and ideal material to construct my design.

**VENEER:** Veneer gives a cleaner and more attractive look. My first veneer choice was pear wood, however this was far out of budget zone. I then went on to find mahogany veneer. When working with veneer I found that it was particularly fragile and brittle.

**MAHOGANY:** To finish the construction side of my design I will be capping the sides with mahogany. This means my design will be structurally stronger and safer to use. It is important that the wood I use to cap the sides matches the veneer on the top of my design.

**SOFT MATERIALS:** With help from the sewing department I was able to design and create a cushion to be used when the design is a chair. This not only creates a more user-friendly/ comfortable design but ensures that you are not sitting directly on the table top (cultural sensitivity).



# DEVELOPMENT - STRENGTH TESTING AND TRIALING

An important stage in creating my design was testing its strength. I had to be sure that the materials used would be strong enough to safely hold at least two people. This is because my design is a two seater chair as well as a coffee table. Safety is an important aspect when designing furniture.



In order to accurately test the strength of my design I had to make a replicate. To do this I used bendy ply and re-created the flat section of my actual design. I did this by gluing, layering and then clamping each piece of bendy ply together. Once I was satisfied with the replicate piece I was able to conduct some tests regarding the strength. Below is a picture of the replicate piece being glued together. As seen in the picture I used two pieces of bendy ply on the outside of a frame of bendy ply.



As seen in the diagram above I used two stands to support the replicate flat surface. I then began adding weights slowly and measuring the deflect After each weight.(As seen in second picture) My results were carefully recorded and are shown in a table below.

Weight	Deflection
20kg	1mm
40kg	2mm
60kg	3.5mm
80kg	4mm
100kg	5mm

After analysing the data I found that there is definitely room for improvement for the strength. I then decided to cap the sides. I did this hoping that it would create extra strength .This means the flat surface shouldn't deflect . I repeated the same experiment with these added features and got the following results:

Weight	Deflection
20kg	0.75mm
40kg	1.75mm
60kg	2.3mm
80kg	2.5mm
100kg	2.9mm

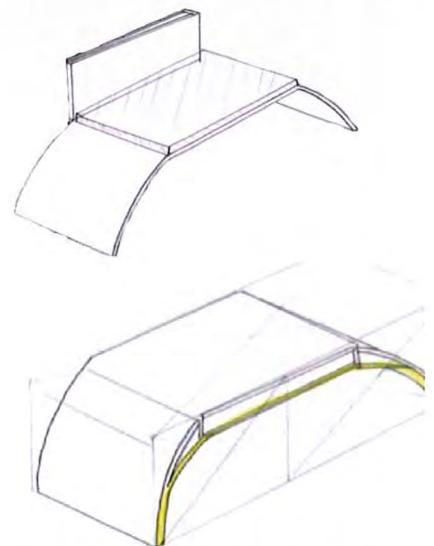
Again I Repeated the test with pine running down the centre for added strength:

Weight	Deflection
20kg	0.5mm
40kg	0.75mm
60kg	1.5mm
80kg	1.75mm
100kg	2.5mm

After completing this experiment I learnt that the most structurally safe outcome was to cap the sides with either mahogany or pine. I found straight away that with capped sides it was slightly stronger than without. The results concluded that with these extra features it will hold over 100kgs safely. I will also place a strong panel in the centre between each piece of bendy ply. This will provide extra strength.

It was very important that I conducted some tests to be sure that my design was structurally safe. This is because it is a potential hazard if the design is not strong enough to hold at least two people.

For added strength I also changed the framing of my original concept. This can be seen in the sketches below. The yellow represents the added frame work. This added structure will provide added strength.



After completing some testing and trialing I was able to develop my design so that it is strong and safe to use. My design has changed drastically from the original concept. I will be adding capping along the edges as well as a piece of timber running down the centre on the inside. I have also changed the aesthetics of the design by adding an extra layer running underneath (shown with yellow in diagram). Not only will this provide extra structure and strength but becomes added storage. Magazines and books can be hidden away in the cubby hole.

# DEVELOPMENT

## LAMINATING

Laminating is going to be a key stage in my design process. To correctly carry out this process I will need to do some further research on how laminating curves works and the history of laminating. Laminating is a process commonly used in boat building and bridges. Laminating was originally used to create extra strength in buildings structurally. However it is now used in furniture and product design too. There are multiple different ways to laminate curves. These include,

### -Creating a mould

This is a particularly straight forward process. Layers of wood are clamped to the mould with glue in-between.

### -Applying water

When water is applied to wood it dries and shrinks the wood. This will create a very subtle curve.

### -Applying heat

Using heat wood can be welded into a desired shape. This process makes it difficult to get a specific curve.

### -Adhesives

All of these techniques are effective for creating a curve. However my design requires quite a tight curve. this means I will need to use a mould. This was I cant perfect the shape of the curve and ensure that it dries in the intended shape. I will begin my laminating process by carrying out some testing and trailing with different materials. these materials will include MDF and bendy ply. once i have found an effective material i will be able to establish the radius of my curve and make a mould. A problem that often occurs when laminating curves is it can sometimes have spring back. The Wood benders handbook says;

*"Timber retains its elasticity, however, resulting in its resuming its original shape when the bending force is removed. By attaching the bent member to another adjacent piece shaped similarly to that of the required bend, the curve may be retained"* - Zachary Taylor.

I will do some further research to ensure that spring back does not effect the shape of my curve.

A formula used to calculate the spring back of a curve;

$$y=x/z^2$$

y is the amount of spring back (the natural tendency for the wood to go back to being straight again after being bent to the desired curve while laminating) measured at one end of the curve with the other end in place on the jig, and all other clamps removed

x is the depth of the cord of the desired curve

z is the number of layers of wood used in the laminated layup

source: <http://forum.woodenboat.com/showthread.php?163522-Formula-for-quot-springback-quot-when-laminating-curves>

This will be particularly helpful when testing and trailing with potential different materials for my curve. This formula means that I can calculate the spring back of my design and minus it from the original shape. This will mean I have made some allowance for the spring back of the curve.

A New Zealand design company known for their quirky laminated designs is "Simon James design". I was able to look at some of their recent products in comparison to one that has been used. This gave me a better idea of how a laminated piece of furniture can wear down through years of use and how i can minimise damage in my design.



Above is a Simon James laminated coffee table. As seen in the picture the table is made with very tight curves and treated/painted wood. Although the design has been covered in a thick resin it has still been effected with its years of use.



Table designed by: <http://simonjamesdesign.com>

The picture above shows the damage done to the coffee table after years of use. As seen in the picture the sides of the table have been chipped. This is due to long term use. I will need to ensure that this is something I take into consideration when designing my product. What is it that has caused this damage? How can i prevent this?

It is said that the more layers used in a lamination the better the curve will keep its shape. It is also said that a lamination with less than 3 layers will never hold its shape (unless the design is flat). The radius of the curve always varies between materials. Seeing the curve that I will be doing is quite tight I will need to test materials. This will help me to determine what the best material is more such a tight curve.

<http://lumberjocks.com/GnarlyErik/blog/40535>

I will be testing my curve and laminating technique with both MDF and Bendy Ply.



Bendy Ply



MDF

# CULTURAL SENSITIVITY DEVELOPMENT

It is important that before I develop my table/chair I address the concept of cultural sensitivity.

My multi functional design is both a chair as well as a coffee table. It is considered culturally insensitive to sit on a table. This is because it is said that you should never sit in the same place that you eat, due to both hygiene and spiritual beliefs.

I have conducted some extra research on this idea so that I can find a suitable way to develop my design and make it more culturally sensitive.

*"Sitting on or resting one's backside against a table or desk can offend Māori. A table is where food is served and should not be touched by the "unclean" regions. Similarly, you should not sit on a pillow, the head is tapu (sacred), and pillows are for resting heads only."* -[https://en.wikipedia.org/wiki/Etiquette\\_in\\_Australia\\_and\\_New\\_Zealand](https://en.wikipedia.org/wiki/Etiquette_in_Australia_and_New_Zealand)

According to the halls in Victoria university it is actually in the dormitory handbook that is is considered offensive to sit on a table. This information proves that sitting on a table is offensive among many cultures and is not appropriate in communal areas.

*"Avoid sitting on tables, particularly tables with food on them or those likely to have food on them at any point. Avoid putting bags on tables. Instead place them on the floor or a chair. Why? Putting your bottom or carry bag on the table is perceived to be unhygienic. Not sitting on tables is also linked to Māori beliefs about the tapu nature of bodily wastes and the need to keep them separate from food."* -<http://www.victoria.ac.nz/maori-at-victoria/ako/teaching-resources/tikanga-tips>



## SOLUTION

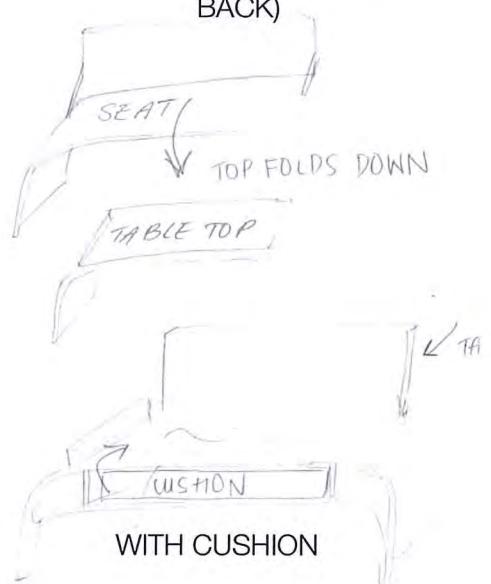
After talking to Mrs Arlidge we came up with two possible solutions to this issue:

- Adding a cushion
- Adding an extra surface that is used only for when the design is a coffee table.

It is apparent that as long as the user is not sitting directly on the surface area of the table then it is ok. After thinking up some ideas I felt that perhaps combining both of these ideas would bring the best final outcome. I will be able to go to the sewing teacher for some information/advice on how to make a cushion for my design.

Sketches of these two developments are shown below:

ADDED EXTRA SURFACE (SEAT BACK)

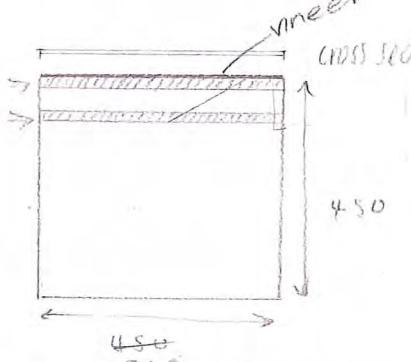


WITH CUSHION

3. Is it a relatively new idea that it is offensive to sit on a table, or is this something that been around in the history of maori culture?  
*"Its always been tradition not to sit on a table, for cultural and hygienic reasons"*

After consulting with one of my stakeholders I was able to gain a better understanding of the maori culture and what it means to sit on a table. After brainstorming some ideas with Miss Alidge we were able to come up with a couple concepts that would work to create a more culturally sensitive design.

# DEVELOPMENT FUNCTIONALITY

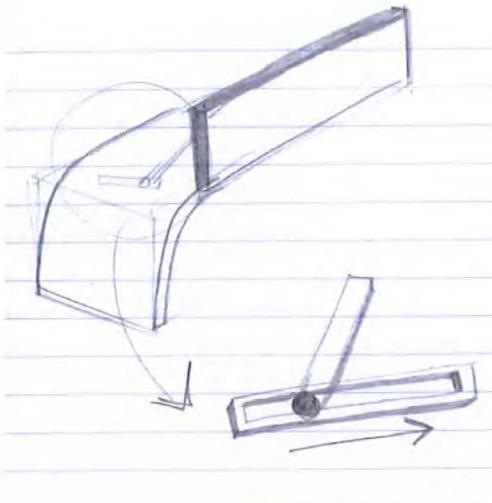


The sketch above is a cross section of how I believe the design should look at this stage. As seen in the drawing there is a top layer that will act as the back of the chair. This will lift backwards when the design is being used as a chair and fold down when the design is being used as a coffee table.

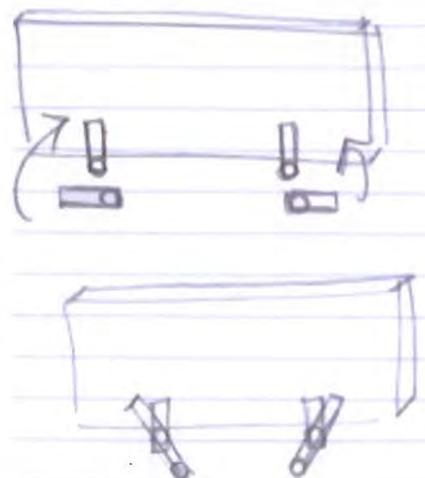
Below are some sketches and mechanisms of the different ways in which the back of the chair could function.



The mechanism of the back of the chair lifting is similar to that of a window. I have gotten these images from the Bunnings and mitre 10 websites. Both of these work to open a window. I have done some sketches that may work to create a functioning design.

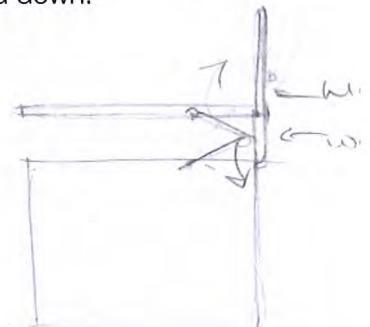


The sketch above shows one of my ideas for perhaps the functionality of my design. Using a slider effect, as the back of the chair is lifted; the slider goes through the metal frame and locks into place at the end. Although I have drawn this idea I will still need to find a mechanism that is similar in store. This idea is quite similar to the window slider from Bunnings shown on the left. I feel as though the only problem with this mechanism would be finding a way for it to safely lock into place whilst the back of the chair is lifted.



Another idea I had would to use flat panels that fold over the back of the chair when it is lifted. Quite similar to what is used on the back inside of a picture frame. As seen in the sketch above the user would have to swivel the piece up so that the back of the chair would be locked into place.

Can potentially use a mechanism similar to a window opener. As seen in the diagram above it is a lot like a V shape. This will open and close as the back of the chair is pulled up and pushed down.



Can potentially use a mechanism similar to a window opener. As seen in the diagram above it is a lot like a V shape. This will open and close as the back of the chair is pulled up and pushed down.



I was lucky enough that my teacher found these desk stays from Bunnings. After drawing up some sketches we found that this would be the best mechanism to use. As the back of the chair is lifted the desk stay locks into place and holds the weight of the back of the chair. These are not the most attractive looking pieces, but this is definitely the most effective and functional choice.

# DEVELOPMENT

## HEALTH AND SAFETY

### RESEARCH

My chosen design is a multi functional piece that has the functions of both a coffee table and a two seater chair. Before I am able to develop my design and finalise any sizes I must do some research in health and safety in furniture design.

There are many legal requirements with professional furniture design. An example of this is often seen in public places such as a bus stop. A chair must be the appropriate height to ensure that it does not cause harm or discomfort to the occupant. This means it must be short enough for the people that are below average in height. This is because a chair that is too high can cause pressure on the back of the thighs and can be detrimental to your physical health by resulting in blood clotting and varicose veins. I will need to take this into consideration when designing my product

An existing design famous for its hazardous malfunction is the famous multi functional murphy bed. As talked about in my existing products the murphy bed is one of the most prestigious space saving furniture designs in history. however, after the 1906 san Francisco earth quake, thousands of murphy beds snapped up and harmed thousands of occupants and even killing one.

There have been many other reports of malfunctioning and hazardous furniture throughout history. As seen in the information to the right many different potential accidents and injuries that can arise from furniture. I must take these into account when designing my product so that I can be sure that my design is safe to use in the short term and long term.

I will separate the information to the right into potential short term and long term accidents.

#### I DONT OWN THE FOLLOWING INFORMATION:

"Potential hazards with furniture;

- Tip overs

*Children are most often injured by furniture, such as armoires, bookcases, and dressers, which topple over onto them. This tipping over can be caused by poor weight distribution, uneven floor surfaces, faulty design, a child hanging onto them, or a combination of these factors.*

- Burns

*Lamps can be quite dangerous in the home. Each year thousands of people sustain second and third degree burns from defective lamps, hot light bulbs, and defective electrical wiring. Lamp bulbs should be the wattage recommended by the manufacturer.*

*Even the highest quality lamps can topple over when not placed safely. Lamps should be grounded whenever called for. Failure to do so can cause electric shock to anyone who touches an exposed piece of its wiring. Also, electrical lines running from the lamps must be hidden to avoid anyone tripping and injuring themselves.*

- Poisoning

*Every day in the United States, people are poisoned by their furniture, or more specifically, the materials used in its construction.*

*Did you know the supple leather of a beautiful sofa may be poisoning you, little by little each day? Maybe you're experiencing chronic headaches, you've developed a rash, or your eyes are tearing for no apparent reason. If so, there's a chance your symptoms are being caused by subtle poisoning.*

*Leather is most commonly made from cowhide, which in its natural state doesn't contain dangerous chemicals. But by the time that leather sofa rolls off the truck into your home, it's gone through a manufacturing process of chemical tanning, coloring, and the addition of formaldehyde and fungicides to help preserve the leather.*

*Formaldehyde is a toxic carcinogen.*

*Fungicides are chemical compounds used to kill fungi or inhibit fungal spores in the leather. That's some terrible stuff! And if your new furniture has any plastic on it, it's likely been treated with polyvinyl chloride, another toxic chemical compound."*

SOURCE: <http://www.injuryclaimcoach.com/dangerous-furniture.html>

SHORT TERM INJURY

LONG TERM INJURY

# DEVELOPMENT RESEARCH SUSTAINABILITY

It is important that I gain an understanding of sustainability in design and the life cycle of a product. This way I will be able to apply sustainability to my design wherever possible.

**WHAT IS SUSTAINABLE DESIGN?**  
I believe sustainable design means to create a product that has no harmful effect on the earth and our resources. A sustainable design has an equal balance of eco friendly resources, minimisation of non renewable energy consumption, social factors as well as functional and aesthetic factors. A sustainable design works to help serve a purpose without compromising the environment and our given resources.

REDUSED, REUSED, RECYCLED.

## SUSTAINABLE MATERIALS

1. Corrugated Cardboard- Incredibly sustainable material, able to be broken down naturally as it is made from the pulp of recycled paper. However it is said that cardboard manufacturing mills are the biggest polluters in the world currently. Designers tried to make an environmentally friendly cardboard "slinky". With the intention of phasing in sustainable and recyclable toys for the latest generation. However being made of cardboard it was not very effective as it was easily broken and very expensive. The major flaw in this product is that the designers did not do enough researching into their target consumers. With children being the main users of the common slinky they would need to take into consideration how the child plays with a slinky and how durable it would need to be.



2. Bamboo- Famous for its low impact on the environment. Bamboo is an extremely sustainable and eco friendly material. Designers all over the world are trying to find ways to incorporate it into design. Bamboo is able to be grown in massive amounts. The more that it is harvested the faster it will want to grow. Bamboo is actually in the grass family rather than the wood family. It is known for being the fastest growing woody material on the planet. Bamboo can actually consume toxins from the air creating a cleaner and fresher environment.



## WHAT WILL I BE USING IN MY DESIGN?

WOOD- the only natural renewable building material in the world. "Over 90% of the wood we use comes from Europe's forests, 1 which are growing by 661,000 hectares every year2 - that's an area the size of three football pitches every hour of the day and night." -<http://www.bwf.org.uk/choose-wood>

That is an incredible amount of wood growing constantly. This shows the way wood is a resource that the world is not running out of quickly. Wood is extremely durable, sustainable and is able to be used for a huge range of construction processes.

## LIFE CYCLE OF WOOD:

- Grows, absorbing co2 and photosynthesising.
- Once the tree has reached its full height it will get cut down and made into either, veneer, planks or panels.
- The smaller branches and spare parts are ground down and made into MDF.(nothing wasted)
- Products are made
- When the product has reached the

end of its life cycle the reusable pieces are separated from the un usable pieces. The recyclable pieces are ground down and remade into panels. (this has created a second life) in some cases one piece of furniture can have multiple lives. -Wood that was not able to be recycled is used as carbon neutral fuel.

[decospan.com](http://decospan.com/us/Ecology/Wood_and_the_environment/) says "*Wood is never just wood. Wood is a renewable, versatile raw material that provides our society with oxygen, both literally and metaphorically.*"

## METAL DETAILING: (Hinges, brackets etc...)

Seeing my design is multi functional It is inevitable that my design will have some sort of metal detailing. Although metal is not the most sustainable material it is able to be melted down and recycled. It is said that steel is recycled more than any other material in the world combined. This is because it is virtually impossible to naturally biodegrade. It is said that Two out of three tons of new steel has been made from scrap steel. The only reason that there isn't more is because of long term steel such as bridges and buildings. <http://www.bordersteelandrecycling.com/STEEL%20RECYCLING.html> This information means that by using steel or aluminium detailing pieces of my design will need to be recycled at the end of its life span.

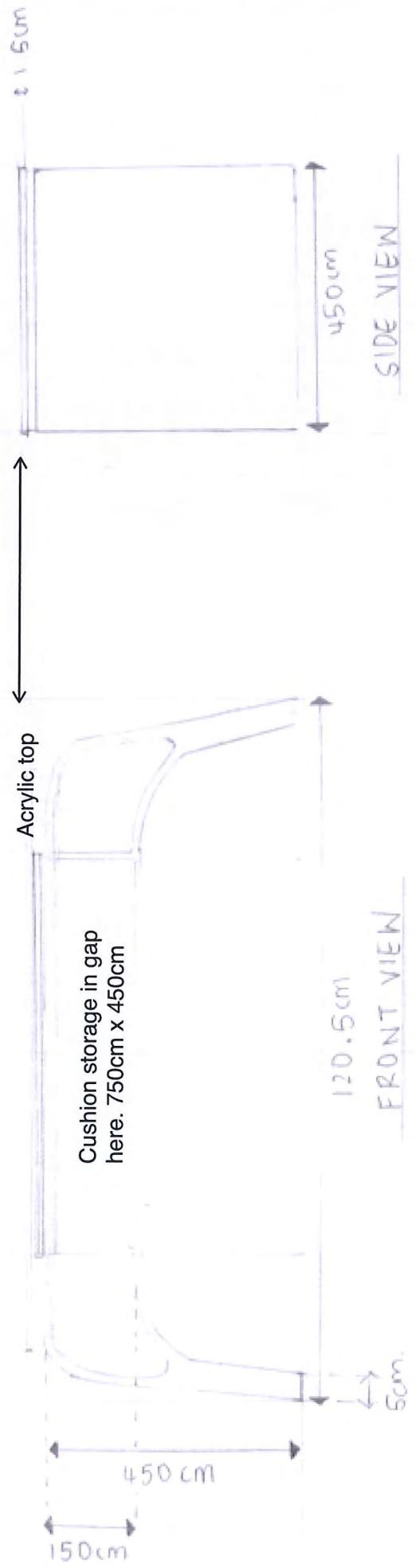
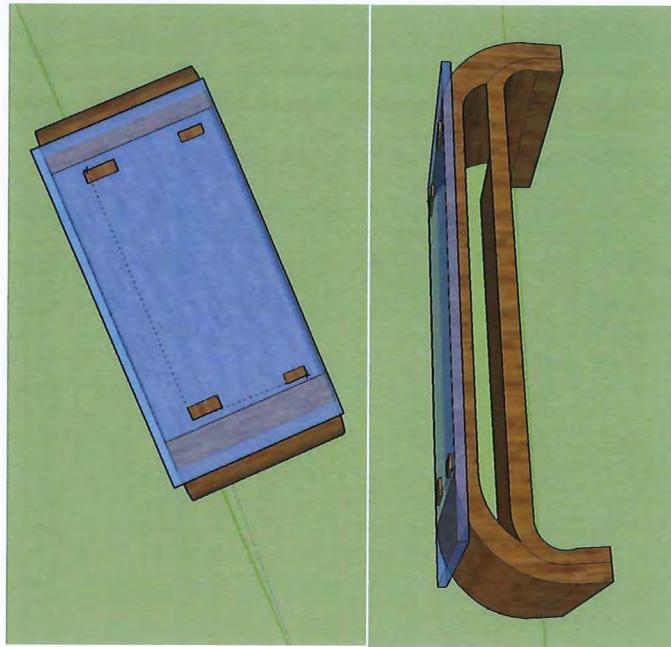
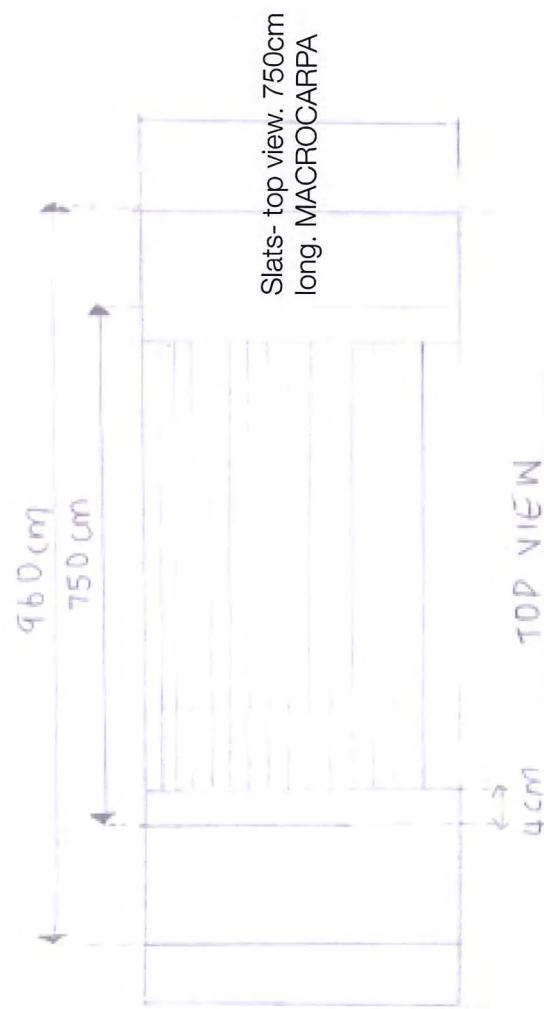
## CONCLUSION:

I am pleased to be able to conclude that wood is one of the most sustainable building materials on the planet. Although in my design I may need to include some metal and potentially acrylic detailing the majority of my design will be recyclable and/or decomposable.

Source: [http://www.decospan.com/us/Ecology/Wood\\_and\\_the\\_environment/](http://www.decospan.com/us/Ecology/Wood_and_the_environment/)

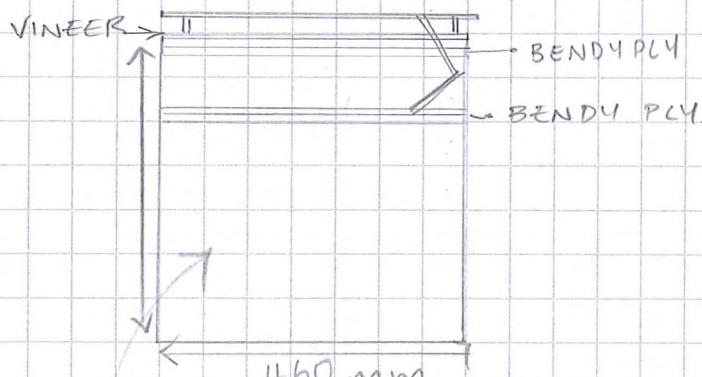
- <http://www.genco.com/insights/reverse-logistics-concerns-considerations-best-practices/>
- <http://www.packnetltd.com/blog/how-environmentally-friendly-is-corrugated-cardboard/>
- <http://www.bamboofencer.com/About-Bamboo/Bamboo-Sustainability>

# ORTHOGRAPHIC + MEASUREMENTS

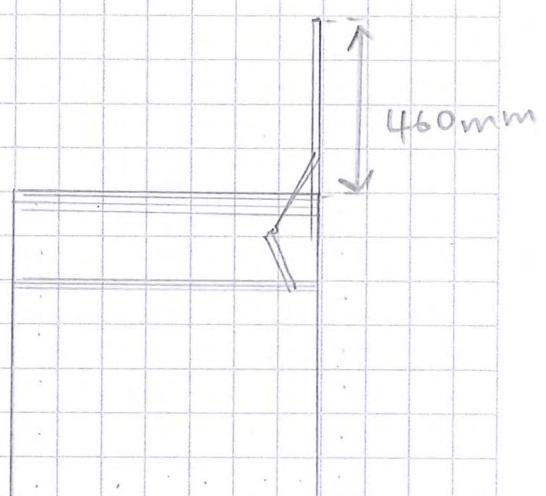


# WORKING DRAWINGS.

COFFEE TABLE

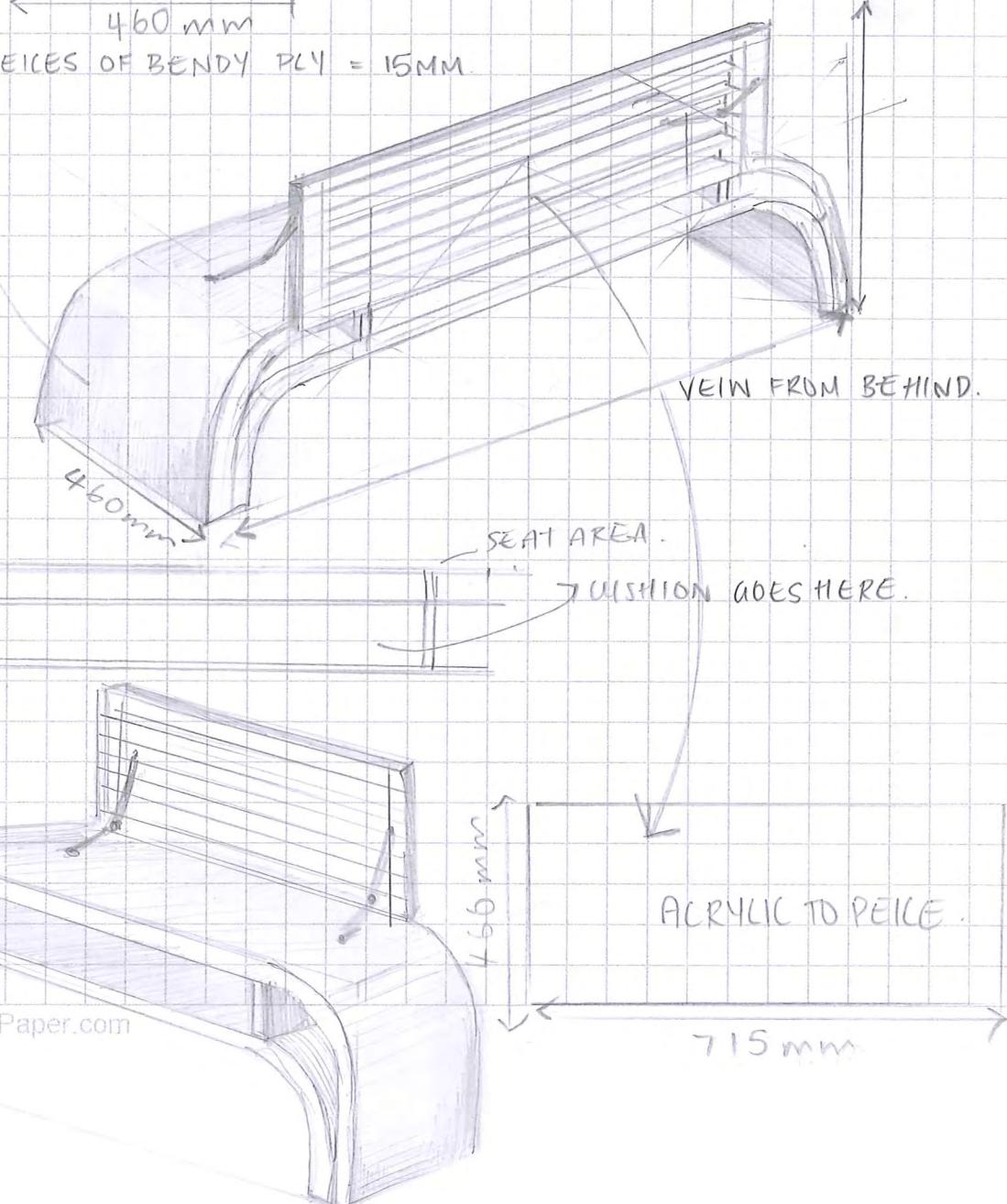


CHAIR.



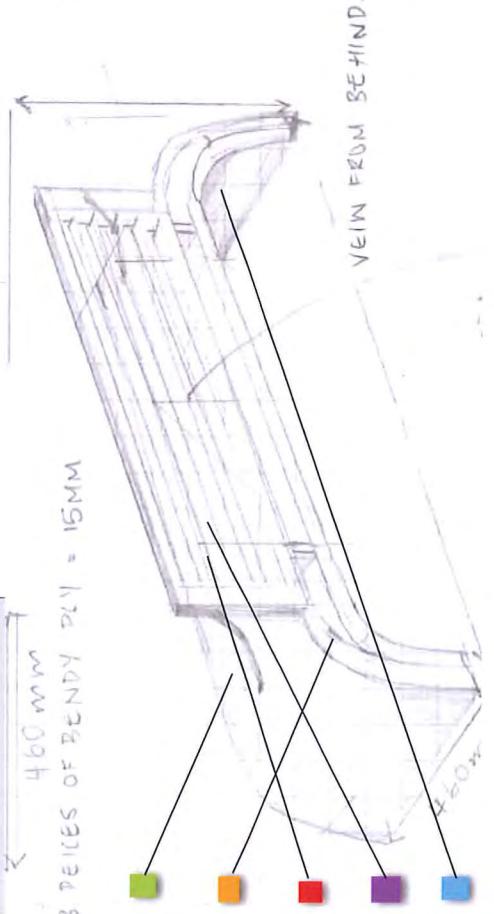
CROSS SECTION

NOTE : 3 PEICES OF BENDY PLY = 15MM.



## CUTTING LIST

MATERIALS	AMOUNT (NO. PIECES)	THICKNESS	MEASUREMENTS	NOTES	COST
BENDY PLY	5X	5mm	200cmx50cm (Will be excess trimmings)	-4 pieces used to cover the topside and underneath of each frame. - 1 Piece used to be cut and layered for the frame work.	\$70
MAHOGANY VINEER	2X	0.6mm	200cmx50cm (Will be excess trimmings)	-1 piece for the top layer and one piece for the second layer. (slightly more left over)	\$60
MAHOGANY	1X	1.5cm	1m <sup>2</sup>	Used to cap the sides (for added strength).	\$5
MACROCARPA	1X	1.5cm	1m <sup>2</sup>	Used for the slats and back area of the chair.	\$5
ACRYLIC	1X	1.5cm	96cm x 46.5cm	Bought from: <a href="http://www.modernplastics.co.nz">http://www.modernplastics.co.nz</a> .	\$120 with a wholesale discount: \$80.



Creating a cutting list meant that I could get a clear understanding of what materials I would need for my design. It also meant I could add up exactly how much my product will cost. The school covers the first \$50 of materials costs. This leaves me with \$170 of extra costs. In my specifications I had a budget of \$150. This means I went over my set budget of \$170. This is because I did not factor in that I would be using acrylic. I decided to use acrylic during the manufacturing stage (long after I had created my specifications). Using the key to the left you can see what materials will be used where on the design.

# PROCESSES

I began my construction process with making a mould so that I can laminate my curves. This is because it is these initial curves that will make up the frame of my prototype.



I began making the frame by drawing out a 2D sketch of my design on a piece of MDF. This had to be to the exact correct measurement as I would be using it to create the mould for my actual design. I was able to draw up the perfect curve as I have already done some testing and trailing earlier.



I then began to glue and screw down some blocks onto the MDF. This is what created the shape for the MDF to be moulded with. Before screwing the blocks on I had to drill some pilot holes. I was then able to add glue and attach all of the blocks.



Once the blocks were attached I was left with a basic frame. I then began to add tape onto the MDF to ensure that my laminating doesn't stick to the mould.



<http://www.podsvojostreho.net/forum/viewtopic.php?f=5&t=52046&start=60>

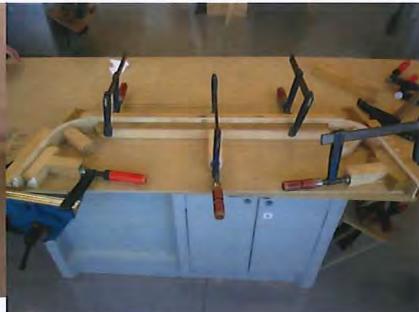
I then began cutting my strips of bendy ply. These strips will be laminated together inside the curved mould. This would make up the basic frame of my prototype.



Using a roller I began to apply glue evenly onto each strip of bendy ply. These pieces would be layered in groups of three. I found that 3 pieces of bendy ply = 15mm. Once these were glued I was able to place them into the mould that was made earlier.



Once the layers of bendy ply was glued I was then able to place them into the mould. I had to be sure that there were no air bubbles. I added clamps to the blocks to put extra pressure on the areas that seemed to be separating. I had to ensure that I applied a lot of pressure to the flat surface of the design. This is so that it remains flat and is able to be used for its coffee table function.



This process was then repeated another 3 times. Again for the top layer and twice for the smaller lower layer. It took a while to complete these stages as I only had one mould and had to wait for each piece to dry overnight.



Once all the pieces have been removed from the mould I was able to gain a particularly clear understanding of how my design would look once it has been put together. At this point I was able to show the basic frame shape to my stakeholders.



Using clamps and a piece of ply I was able to do a dry run of my design. At this point I had a clear understanding of my design and was able to use this photo to sketch up some ideas for the functionality of the table top/back rest. I would soon be able to cover my design with bendy ply which will really bring it together.

# PROCESSES



clamps over the corners so that there were no air bubbles. This procedure then had to be repeated for the top layer. But before I did this I would cover the bottom layer with veneer. This is because once the top is secured I will not be able to put veneer on the bottom layer.

The next step in my construction process consisted of adding the layers of bendy ply on top of the frame work. It was important that I clamped it so that there was no air bubbles. I left it to dry overnight and then I was able to start adding a piece onto the other side of the frame work. The piece of pine in the centre (seen in photo) is used to give added strength to the design. (Refer to development)



As seen in the photo above this process was repeated for the other side. It was important that I used blocks underneath the clamps. This means that the pressure can be dispersed evenly over the ply. It had to be left for a night to dry effectively. Again I had to be sure that there were no air bubbles. I added clamps accordingly. This process was repeated for the top layer of the product as well as the bottom layer. This meant that it used 4 pieces of 200mmx50mm bendy ply.



As seen in the picture above, blocks were added on each side so that the clamps could evenly distribute their pressure over the



I began by using metal rule and a craft knife to carefully cut the veneer. I had used my cutting list to measure out how much was needed. I found that it was very delicate and had to apply tape to a couple small rips.



I applied glue to both the underside of the veneer and the top of the product. This meant that I would not miss any patches. It was important that I applied a lot of pressure to the flat surface area on the top of the design. To do this I used a piece of MDF over the top (as seen in the photo above). I then went on to clamp it with blocks on either side.



Although it is hard to see, I did find that once dried and unclamped it had some ripples in the top. This is because I didn't add enough

pressure. The next time that I do this I will need to clamp on extra blocks so that there is absolutely no way that it can dry with ripples.



I then had to cover the second layer in bendy ply and then veneer. However I was slightly set back when I found that the framework was slightly too small. This may be because I didn't correctly cater for the spring back in the lower layer. I needed to find a way to extend it in the centre without effecting the strength. After brainstorming some potential solutions I came up with this.



The black lines represent the existing design and the red represent the inserts that will extend the length. Although it's hard to see this is shown in the picture below. As seen in the picture, once I had cut all of the inserts I was able to glue and clamp them in using blocks on either side for added pressure. Although this was a tedious set back in the construction of my design I didn't effect the strength in the long run.



Once this framework was extended I was able to do a dry run.

# PROCESSES



As seen in the picture above I did a dry run of what had been completed so far. Using blocks and clamps I was able to prop up the framework so I could see exactly how my final design should look. The next step in my construction process is covering the framework in bendy ply followed by veneer.



I then went on to add veneer onto the top layer. As seen in the picture above, I use a lot of clamps and blocks to ensure that pressure was added over the entire surface. This would mean that there will be no air bubbles underneath the veneer. I waited for this to dry over night before I unclamped it and moved onto the next step.



Before I capped the sides I needed to cut the pieces of mahogany to fit the edges. I began by tracing the edges of my design onto mahogany and then I was able to cut the shape on the bandsaw. I had to make 4 for each corner.



Before covering the framework in bendy ply I had to create the structural beam for the in the centre. It ended up being an I shape so that it would stay in position. Although glue would probably keep it in the centre, it's better to be certain that it won't come unstuck.



I went around the edges with a craft knife and removed any overhanging veneer. This procedure was very tedious and I did accidentally create a few chips. This is because I needed to glue the veneer right to the edges.



Once all four pieces were cut and ready I sanded them and prepared to glue them to the sides. I also had to cut 4 long pieces to be places on the flat sections.



As seen in the picture above I glued/ taped and clamped the capping onto the sides. Again using blocks



After adding the bendy ply to the outsider side of the framework I was able to put the pine inside using glue. Once that was done I added glue to the outside and put the second layer of bendy ply on. Again like earlier I used clamps and blocks to ensure that it was tightly secured with no air bubbles. I am now able to glue each piece together,

Once I had applied veneer to both layers and glued each layer together my design looked like this. As seen in the picture above I had added two pieces of mahogany inside to create a space for the cushion to be placed. Not only did this provide a storage area but added extra structure and strength to the design. Each piece was around 13cm x 45cm. I now have to cap the edges. This will give the design a very attractive and finished look.



All the capping was glued, taped and clamped overnight to ensure it was tightly secured onto the sides.

# PROCESSES



I also added capping onto the pieces of mahogany that ran across the inside. This was glued and taped. This made the design look complete, like one piece. I then had to route the sides. This would clean up any rough edges.



Using these I was able to prick the corresponding sides so that I knew exactly where to drill holes so that they matched up. This was a very effective way to match up all of the pieces. I labelled all the parts so that I didn't lose track of what pieces matched up. Once all the pieces were drilled I was able to cut all the pieces of dowel and glue them into place.



I dry assembled all of the slats and measured out an even space between each piece. Using a ruler and pencil I marked out exactly where each slat would be placed I was now able to glue and clamp all the slats down onto the frame.



As seen above I routed the edges. First with a straight edge. So that the capping is flush with the veneer. I then routed it again with a rounded piece. This looked a lot more attractive and final. It was a little tricky routing the inside curved parts. This is because there is nothing behind the curve for the router to use as a guide. This meant I was free handing it.



I placed glue into each drilled hole and then gutted all the pieces of dowel together. Once the frame was together it looked like this:  
(NOTE THIS IS WITHOUT CLAMPS)



Before I was able to route the edges of the slats I had to sand them down so that they had a nice finish. I used an electric sander.



Using a rounded router I routed the edges of the slats. This meant that the chair would be a lot more comfortable to sit on and user-friendly.

I then began to make the frame of the back rest. I decided that I would make it using dowel joints. This is an effective way to get a strong yet simple joint. I began by measuring out all the pieces. Once this was done I paired all the pieces and marked out where I would need to drill holes for the dowels. Using the dowel machine I was able to start drilling all of the holes. It was important that I carefully matched up all the pieces.

I then had to begin making the slats to go across the frame. I decided not to use mahogany for this because it would give a nice contrast. Instead of mahogany I decided to use Macrocarya. This was left over at school so this would also save resources and money. I began measuring out the slats and cut them on the band saw. Once they were cut I was able to do a dry assemble inside the frame.

Once the back rest was completed I was able to attach it onto the back of the chair. I have previously done some brainstorming and found that I would use "desk stays" from Bunnings to make the back rest lift up and down.

# PROCESSES



I began the process of attaching the back rest by drilling some pilot holes. To do this I placed the hinges onto the intended spot so that I could get the correct spot. Once these were down i was able to attach the back rest on with the hinges.



I then added the desk stays. To do this I drilled through he first layer of the design. Using a screw and nut I screwed them down. I was pleased that the back rest went up and down smoothly. My design was nearly completed. I just needed to add some finishing touches.



I used a plane to even out the bottom of table. This was a long process getting each side even. I then added some thin pieces onto the bottom and routed the sides so that they were invisible from eye view. Added some flat pieces onto the "feet" of the design almost gave the table a floating look. This is because they were routed and unable to be seen from eye level.

## CUSHION



To begin my cushion I needed to have a stakeholder consultation with the sewing teacher. This would give me some information of the best way to design and create the cushion. I began by buying some custom cut foam from para rubber. <http://pararubber.co.nz>. I then had to make a pattern for my cushion. This was very simple and done on some paper. I then pinned the pattern to my material and was able to begin cutting out my material. This is seen below;



Once all the pieces were cut to size I was able to pin all the parts together and prepare to sew.



I sewed the cover inside out so that there would be no seams showing when i pulled it the right way around. I also added a zip so that when the cushion gets dirty is able to be easily washed. I did have bit of trouble getting the form to fit through the zip as the foam was quite rigid. My finished cushion is shown below;

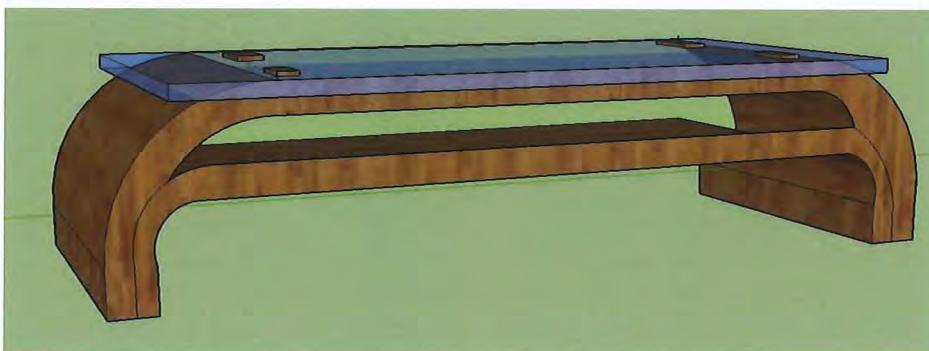


Lastly for finishing touches I sanded and varnished the table. Varnishing the table will provide longevity so that is is resistant against potential spills and scratches. I used a speed drying "silk" varnish to coat my design.

I was then able to apply the acrylic onto the top. I had bought some screws and that would look appealing from the top of the table. Applying the acrylic was very easy,I simply drilled through he back rest of the chair on each corner and through the acrylic. I was then able to screw the acrylic onto the back of the chair.A picture of the screwed down acrylic is shown below.



# WORKING WITH ACRYLIC:



As seen in the picture above the acrylic will lay over the top of the design as a nice finished surface.

Originally I wanted my design to be covered in glass. However after the development stages when I had figured out the logistics of the back rest I realised that it would need to be a lighter material. This is because as the back of the chair is lifted the acrylic would be attached to the back. Once I had the correct measurements for the acrylic I was able to go to MODERN PLASTICS in freeman's bay NZ to get it custom cut. When I arrived I was given a choice of colours and thicknesses to choose from. After consulting with my teacher and stakeholders I decided to buy the 1.5cm thick translucent acrylic. Aesthetically this will look simple and pleasing. (A lot like glass) and for functional reasons, the translucent means you will still be able to see through to the magazines.

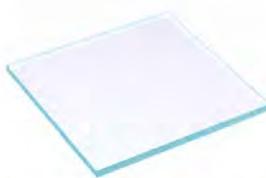
## TYPES OF ACRYLIC:

Coloured acrylic:



Will have a life span of about 15-20years. UV protected. Can withstand any sort of outdoor weather climates.

Green edge acrylic:



Designed to look like glass. It is infused with a slight amount of green dye when it is being made. This is what gives the edges a green tint.

Black or White opaque acrylic:



The only acrylic that is not translucent. Ideal for kitchen tiles. Nice smooth finish.

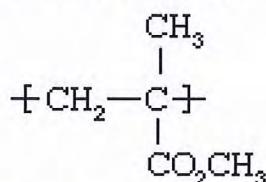
Clear acrylic:



Same properties as coloured acrylic but with no added dyes and tints.

source: <http://www.modernplastics.co.nz/products/acrylic/>

"Polymethyl methacrylate (PMMA), a synthetic resin produced from the polymerization of methyl methacrylate. A transparent and rigid plastic, PMMA is often used as a substitute for glass in products such as shatterproof windows, skylights, illuminated signs, and aircraft canopies. It is sold under the trademarks Plexiglas, Lucite, and Perspex." <http://www.britannica.com/science/polymethyl-methacrylate>



After doing some research on the translucent acrylic from modern plastics I found that is is very commonly used as a substitute for glass. this was good information as I too would be using it as a lighter and more user friendly substitute for glass. Modern plastics says that acrylic is half the weight of glass and 9 times stronger than glass.

**COSTS:** When buying a custom cut piece of acrylic I was sure to add 0.5cm to each end of the measurements so that I could cut it perfectly straight in the work shop.

This meant my measurements to be cut were;

97cm



47.5cm

THICKNESS: 1.5cm

This came to \$120NZD however after discussing whole sale prices for Westlake girls I was able purchase it for \$80NZD.

# CUSHION/ RESEARCH AND DESIGN DETAILS

Before I began any sketching and brainstorming my cushion design I had an interview with one of my stakeholders.  
Ms Luesitti (Westlake Girls Sewing teacher).

After talking to Ms Luesitti we came up with some things that I may like to think about for my design,  
-Adding a zip  
-Piping around the edges

I began my cushion by visiting Para Rubber to see what type of foam I wanted for my design. I initially felt as though I wanted to go for something alike a sun bed cushion. These are usually a harder foam which is rectangular in shape with piping around the edges. Para Rubber had three types of foam that would be ideal for a cushion

## -Soft foam

"Our soft foam is great for quilting, seating backs, frame wraps, budget packaging and handcrafts. We can cut your foam to any shape or size while you wait, just bring in your measurements."

## -Firm foam

"Our firm foam is suitable for all types of furniture including, window seats, caravan squabs, seat cushions, seat backs and arms and even mattress's! We can cut your foam to any shape or size while you wait, just bring in your measurements."

## -Memory foam

"Medium memory foam is great as a bed overlay and is also perfect for medical purposes. Memory foam is usually denser than other foam options, this makes it more supportive but also heavier. We can cut your foam to any shape or size while you wait."



<http://pararubber.co.nz/cut-foam/721-soft-foam-.html>

I decided that the soft foam would be most appropriate for my design. This is because it needs to be able to fit through the zip. A denser foam will be harder to take in and out of the cover to wash. I found that the soft foam was comfortable and user friendly. It was the perfect thickness so that it did not compress fully when you sit on it however it does slightly indent.

The second step in my design was gathering materials to make the cover. I decided to go for a simple fern pattern on the top and a cream white on the sides and bottom. This style seems to be on trend at the moment and would suit the natural colour of the mahogany. When talking to Ms Luesitti, she told me that *"If the material is stretchy it will be hard to sew. However if the material is too dense it will be tricky adding the piping."*

The material I chose was from the upholstery section of spotlight (<http://www.spotlightstores.com/nz/yarn/c/fabrics-yarn?q=%3Arelevance%3Acategory%3Aupholstery-fabrics&text=>)

This meant that it was ideal for making a cushion. The materials that I chose can be seen in the picture below:



An important process in the construction of my cushion was making the pattern. The pictures below (not my own) show a very similar pattern to that I used for my cushion.



As seen in the pictures to the left the cushion needs to be sewn inside out. This is so that no seams are showing. When making the pattern I had to leave a 15mm space from the sides so that there would be a seam to sew onto. <http://www.acupofthuy.com/diy-tufted-pin-cushions/>

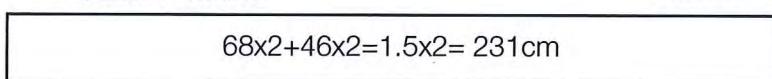
## MY PATTERN:



46cm + 1.5cm

= x2  
TOP + BOTTOM

SIDES



6cm + 1.5cm

$$68 \times 2 + 46 \times 2 - 1.5 \times 2 = 231\text{cm}$$

I purchased a 30cm long cream zip from spotlight to sew into the side of the cushion. Again I had to do this inside out. I did this so that the cover of the cushion is able to be washed and give the cushion a longer life span. However I did find that this zip was slightly too short and it was tricky getting the cushion to fit inside.

# FITNESS FOR PURPOSE IN THE BROADEST SENSE (OVERVIEW)

## LONGEVITY:

I have also added a zip onto the cushion. This means the cushion can be washed when needed. This will give the cushion a longer life span as it can be cleaned when needed. In terms of the table/chair I have varnished it with a silk speed dry varnish. This means that the veneer should be relatively resistant against scratches and spills. Seeing 2015 is a throw away society, a quality and long lasting design means that resources can be saved as the life cycle of this product will be a lot longer than a cheaper product.

## SAFETY:

I have rounded the sides of my capping as well as the slats to ensure that my design will not be sharp and harmful to the user. To do this I used a router. I have also made my design as strong as possible. To do this I tested and trailed using weights from the rowing department. I found that with a piece of pine running down the centre on the inside as well as having the sides capped with mahogany it became stronger and held over 100kgs safely. This can be seen on the testing and trailing "Development" page.

## ERGONOMICS + LEGAL REQUIREMENTS:

Something else that I have addressed whilst making this design was the legal sizing requirements. I had to take into consideration that I would need to make my design size suitable as a chair as well as a coffee table. I found that a comfortable seat is usually around 40cm-45cm tall. Whereas a coffee table is usually around 45cm. This meant that a comfortable height for my design would be around 45cm. It is important that the chair is short enough for people with shorter legs. This is because if a chair is too tall and your feet are not touching the ground there will be added pressure on your thighs. This can cause blood clotting and even varicose veins.

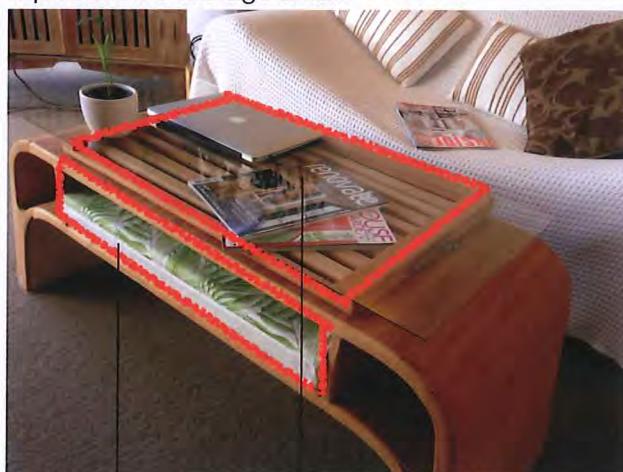
## CULTURAL SENSITIVITY:

I have ensured that my design is ethical after consulting with various stakeholders and researching the idea.(refer to development "cultural sensitivity"). Seeing my design is

Multi functional and can be used as a chair and a table it was important that I addressed the idea of cultural sensitivity. This is because it is considered offensive to sit on a table. During the development stages in my design process I added a cushion and an acrylic surface so that you are not sitting directly on the table.

## INNOVATIVE:

My design is catered for people living in smaller houses. This situation is becoming increasingly popular in Auckland-New Zealand as house prices are rising and it is becoming unaffordable to live in large home. Not only because of the market prices but heating and power bills too. I found that although a small living area may be uncomfortable it is in fact more environmentally and financially friendly. With use of multi functional and innovative furniture you can decrease the amount of furniture but still keep each of the functions of each piece. After having regular consultations with stakeholders I learnt that storage is a huge problem for people living in smaller living spaces. I tried to incorporate storage into my design wherever possible whilst still keeping the simple and de cluttered aesthetic look. In the picture below the red box's represent the storage areas.



When the design is being used as a chair; this space is free to be used for anything, books, ornaments, clothing etc. When the design is being used as a coffee table the cushion is able to be safely stored inside.

Magazines, coasters and thin items can be saved and displayed underneath the acrylic and on top of the slats. This looks aesthetically appealing as well as functional. This space was not originally going to be able to be used for storage, but as I was designing the back rest I felt that this would be a nice place to store magazines and other coffee table related items. Then made the back rest with a gap on one side that can be used to access the storage area.

## SUSTAINABILITY:

The majority of my design can be either broken down or recycled. Most of design is made from bendy ply and mahogany with adhesives. This is all able to be broken down or recycled. However it is said that not a lot of recycling companies will accept acrylic however it is able to be recycled.

# EVALUATION:

At the beginning of the year our hard tech class was given the general context of modern living. After doing some research in this idea I can up with the two contexts of space saving and multi functionality. I found that these two contexts are beginning to get explored by designers in the world of modern living and furniture design. As I did some research on space saving and multi functionality I learnt that more and more new Zealand families are having to cram into smaller living areas. This is because house prices are getting so high. Here in 2015 house prices in Auckland are the highest they have ever been. This is causing the younger generation to flat in crowded areas and to buy smaller houses. Living in a crowded environment can be detrimental to your physical and mental health, making it harder to think and work. I believe that with use of innovative and multi functional furniture you save vast amount of space. I began by conducting some research on these two contexts until I had a clear idea on who my product would be designed for.

I had decided to design my product for a generalised group of consumers. As stated above this group is people that are living in crowded and smaller houses/apartments. This means that I was not designing for one specific client but a large group of people that are dealing with similar living environments. I decided to choose the coffee table/ Chair design. I decided to incorporate curves into my design as this would be an interesting challenge. This also looks modern and aesthetically appealing. During the development stages there were a lot of aspects that I had to take into account. This included ensuring that my design was culturally sensitive, strong, user friendly and aesthetically appealing. To do this I talked to a range of stakeholders including teachers and people living in smaller/crowded houses. These stakeholders helped me to prepare a list of specifications which I have tried to meet to the best of my ability.

**SAFE TO USE:** During the development stages on my design process I tested and trailed with weights from the rowing department to check that my design would safely hold a persons weight. After some thorough testing with different procedures I found that my design safely holds over 100kgs. I have also rounded the edges of both the capping and the acrylic to ensure that there is no sharp hazardous edges.



**MULTI FUNCTIONAL:** I am pleased to say that my design works effectively as both a coffee table and a chair. The user is able to simply flick the back up when extra seating is required. By giving one piece of furniture dual uses you are able to cut down the amount of furniture in a given area. This is exactly what I needed to design as a solution to my issue. When talking to stakeholders I was told that they often had guests over but didn't have extra seating. This would be a quick and easy solution for extra seating. I was also told that storage can be an issue. When the design is being used as a chair the cushion is able to be pulled out and there is a space for storage there.

**CULTURALLY SENSITIVE:** During testing and trailing I had to develop my design so that it would be culturally sensitive. I did this by holding an interview with the Te Reo teacher from Westlake. She gave valuable advice on what would create a more ethical design.

**POTENTIAL IMPROVEMENTS:** I am happy with the overall outcome of my design. However if I were to remake it there would be a couple things that I would do differently. I did strike a small hiccup when making the framework for the top layer of the design. I didn't correctly factor in the spring back of the lower layer and found that the framework needed to be extended (can be seen in processes).

This did set me slightly back in time. I also found that the veneer was very delicate and hard to work with. When it came to trimming the excess veneer on the edges I found that it occasionally chipped. This was because I did not take enough time in ensuring that the glue went all the way to the edges. Apart from these minor details I felt that my design was well made and correctly solves my chosen issue.

Overall by completing in-depth research on the issue, existing design and contexts I was able to gain a good understanding of the project and design process. Before I began my assignment I was sure to carry out some planning including a gantt chart and overview of each step in my design process.

Throughout the development stages of my design I was able to talk to various teachers throughout the school that could give me expert advice on an area that they specialise in. I also talked to various stakeholders who were living in the environment that I am studying.

Another tool that was quite helpful was the anonymous survey that I created on Survey Monkey. I asked questions regarding the relationship between house prices and house sizes. All of this information helped me to develop my design to the best of my ability. I am particularly happy with the modern aesthetics of my design. I think that it is simple and appealing.

## REFLECTION

Throughout this assignment I have learnt a range of different techniques and tools. These consist of; effective time management and planning, researching and analysing a given issue and coming up with a technological outcome. My development stages went relatively smoothly where I explored the functionality, strength and potential materials in my design. Although I did not have a specific client, I found that having a general issue meant that I would need to try and create a design that would be versatile for a range of different people including weights and cultures. I set out to design a piece of furniture that would work to create maximum space in a smaller living environment. This lead me to the coffee table/chair idea. By putting two pieces of furniture into one piece you can eliminate an existing piece creating more room. After talking to various stakeholders in similar living conditions I found that one of their biggest issues with living in a small area is not having enough seating when guests come around. a quick and easy to solution; flicking up the back of the common coffee table and transforming it into a chair. I did decide to make the sides rounded to give it a simple, elegant and modern look. This is because I am aiming this product at people from the younger generation. These are the people being effected as they are flattening and buying smaller homes due to the huge increase of house prices. In my construction process I did challenge myself by incorporating curves and applying veneer. I found that these two processes were challenging however looked effective. I am pleased with the final outcome of my design. It functions flawlessly and looks aesthetically appealing. It is relatively comfortable to sit on and works well as a coffee table. I have tried to address every aspect of fitness for purpose in the broadest sense; cultural sensitivity, sustainability, safety, legal requirements and innovation. I used an array of resources from internet forums, news paper articles, various stakeholders and knowledge from teachers at school. All of these resources helped me to gain a good understanding of each aspect in my development stages. There were many tools that helped me to complete each aspect to my best ability. An example of this is prioritising all of my attributes. In doing this I was able to see what visual points I need to focus on during the development stages. I also found that writing the occasional reflection of what needs to be done next helped me to get a strong understanding of what else is needed in my design process (Final Brief).

# REFERENCES

ALL REFERENCES ARE LISTED ON THE PAGES AS WELL.

<http://www.britannica.com/science/polymethyl-methacrylate>

<http://docs.lib.purdue.edu/cgi/viewcontent.cgi?article=1027&context=cgttheses>

<http://simonjamesdesign.com>

<http://murphybedcompany.tripod.com>

<http://seekayem.com/multifunction-furniture-design-small-house/computer-table-transform-to-bookshelf-and-study-desok-multifunction/>

<http://theredbootquiltcompany.blogspot.co.nz/2015/06/small-folding-table.html>

<http://www.treehugger.com/htgg/how-to-go-green-furniture.html>

<http://paruresishelp.com/clutter-bad-health/>

[https://www.reinz.co.nz/shadomx/apps/fms/fmsdownload.cfm?file\\_uuid=F3EBCFA2-D7C6-447B-8971-2255753849DE&siteName=reinz](https://www.reinz.co.nz/shadomx/apps/fms/fmsdownload.cfm?file_uuid=F3EBCFA2-D7C6-447B-8971-2255753849DE&siteName=reinz)

<http://www.mbie.govt.nz/what-we-do/housing/housing-key-facts>

<http://www.scoop.co.nz/stories/BU1509/S00343/valet-self-storage-sights-up-auckland-apartment-living.htm>

<http://www.coroflot.com/roelverhagen/random>

<http://resourcefurniture.com>

<http://diycozyhome.com/sofa-bunk-bed/>

<http://www.interiordesignshrink.com/blogs/living-large-in-a-small-space/>

<http://blog.modernmechanix.com/portable-globe-house-for-well-rounded-living/mbe.govt.nz>

<http://forum.woodenboat.com/showthread.php?163522-Formula-for-quot-springback-quot-when-laminating-curves>

<http://lumberjocks.com/GnarlyErik/blog/40535>

<http://jalconhomes.co.nz/for-sale/hobsonville-point-stage-2-now-selling-2/>

<http://inhabitat.com/seung-yong-songs-multi-tasking-chair-lets-you-hide-store-and-even-dry-your-clothes-while-you-sit/>

<http://www.modernplastics.co.nz/products/acrylic/>

<http://www.spotlightstores.com/nz/yarn/c/fabrics-yarn?q=%3Arelevance%3Acategory%3Aupholstery-fabrics&text=wisegeek.com>

[scoop.co.nz](#)

<http://www.acupofthuy.com/diy-tufted-pin-cushions/>

<http://pararubber.co.nz/cut-foam/721-soft-foam-.html>

<http://www.injuryclaimcoach.com/dangerous-furniture.html>

[decospan.com](#)

<http://www.bwf.org.uk/choose-wood>

<http://www.bordersteelandrecycling.com/STEEL RECYCLING.html>

[http://www.decospan.com/us/Ecology/Wood\\_and\\_the\\_environment/](http://www.decospan.com/us/Ecology/Wood_and_the_environment/)

<http://www.genco.com/insights/reverse-logistics-concerns-considerations-best-practices/>

<http://www.packnetltd.com/blog/how-environmentally-friendly-is-corrugated-cardboard/>

<http://www.bamboofencer.com/About-Bamboo/Bamboo-Sustainability>

[https://en.wikipedia.org/wiki/Etiquette\\_in\\_Australia\\_and\\_New\\_Zealand](https://en.wikipedia.org/wiki/Etiquette_in_Australia_and_New_Zealand)

<http://www.victoria.ac.nz/maori-at-victoria/ako/teaching-resources/tikanga-tips>

## Hard Materials Scholarship 2015 – Coffee Table Chair

In this report the candidate has submitted a portfolio that demonstrates aspects of high level of analysis, critical thinking and synthesis. She has applied highly developed knowledge and skills. Throughout her report she has shown a clear understanding of her situation and defined logically development of precise and clear ideas.

In the report's brief introduction the candidate clearly states a rich understanding of the initial need; one piece of furniture answering two requirements. Having a rich, and authentic need and opportunity is vital for the candidate to explore the complexities of an issue across the full curriculum strands. The outcome was a dual focus of multi-functionality and space saving furniture for the smaller home (Pg 3).

Concise research into existing technologies follows with a link to environmental and the beginning of sustainability statements (Pg 5,8,9) along with the introduction of a target market, with a good range of potential stakeholder, are further covered and identified at the top of page 7, and page 10 as: students, first home buyers and people who are being effected by rising house prices. The Initial brief further shows the complexities of the situation and variance of the specifications for the target market. Attributes are comprehensively reflected on along with base logic of design.

In Page 6 although the report shows complexity in the previous research the candidate explains how a design of space saving furniture does not have to be complex ie fold down and pull out etc. As explained/expanded further in the report these statements begin to show simplicity and optimisation. A range of concepts are constructed with clear evaluation of the products vs the target markets need, alongside consultation with initial stakeholders (pg13). The candidate reflects on the possible environment where the prototype could be situated (Pages 8,34) Areas such as 2 bedroom houses, student flats and other areas with small living areas, backed up by stakeholder statements are identified. Pages 34,35 show the prototype in the intended environment and in use.

Clear brief development leads to next step planning (pg 14), giving the reader a link to clarified specifications and also a development of the aspects of her target market within a conceptual statement (pg 15).

Page 16 leads to a statement in relation to her technological practice with the radius of her design vs material choice clearly linked to the target markets space saving scenario. Also introduced on this page is the introduction of her exploration of the cultural sensitivities of a table that could be sat on. Pages 20 and 23 further display reflection and applied knowledge with the issue of tapu around the sitting on of a possible eating surface and pages 9,22,34 covering some of the OSH issues and safety.

Throughout the report the candidate displays evidence of on-going critical reflection on the pertinent knowledge gained from a variety of sources pages 4,5,6,7,10,14,19,20,22,23,34 that impacted upon their practice and outcome development. This evidence is further applied throughout the remainder of the portfolio.

Throughout the reading of the portfolio the candidate displays how the reflection of the situation's attributes guide problem-solving, resulting in processes or next steps leading to an outcome which is again reflected on. A great deal of forward thinking is also evident. The candidates brief development is sound, (pages 11,15,16,34 and 35) and the planning is evident throughout the practice often leading to statements of "I will need to" and "I will

be”.

Linking with her journey of research (pages 5-9) to the initial conceptual design ideas (pages 12-14) development of and application of skills (pages 17, 18, 27 – 32) research on how other technologists completed laminating (page 19) and material selection with the relevant testing of materials (pages 17 -19 and 33), functional modelling that guided her practice (pages 17,18, 19, 21) lead to an impressive outcome development that was concisely evaluated both throughout the processes (pages 27- 33) but also comprehensively against the initial needs, briefs and stakeholder feedback.