

Category 3 Inventions Log Book

Title of Project: Table Tennis Windblocker
Group Name: 3 - 32
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Problem Finding

The beginning...

Identify a problem you would like to solve. You may want to brainstorm for problems using different approaches eg thematic, survey or general brainstorming etc.

1 A Document a list of problems you have identified. Your documentation should show clearly how your group came up with the problems.

For our problem, we decided to focus on sports in Hwa Chong institution. We then went to conduct a survey to investigate which sport is the most popular and therefore have the largest target audience. The results of the survey are as follows:

Sports played by students in HCI

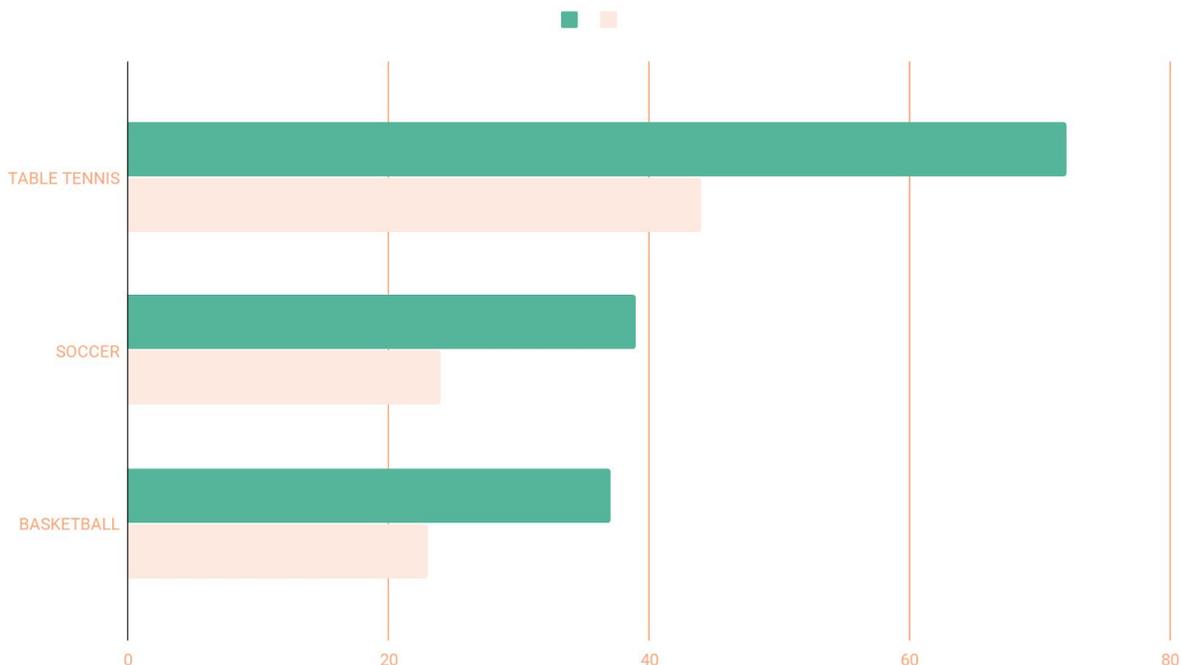


Fig 1.1

Fig 1.1 shows the top three sports played by students in Hwa Chong, according to our survey

In Fig 1.1, the green bar graph represents the percentage of people playing a certain sport (note that the total percentage does not add up as the question was a checkbox question meaning that students could choose more than one option). The orange line graph represents the number of people playing a certain sport. From the results, it is clear to see that, in Hwa Chong institution, the number of students who play table tennis is much more than that of those who play other sports.

Thus, for our problem, we decided to focus on problems faced by students who play table tennis in Hwa Chong.

After making this decision, we then brainstormed on three major problems that students who play table tennis face - uneven table surface, poor bat conditions and strong winds affecting the game. We then conducted another survey to ensure that students who played table tennis in Hwa Chong actually faced these kinds of problems; and to find out how many people face such problems. Therefore, finding out the significance of the problem. The results are as follows:

Problems faced by students playing table tennis

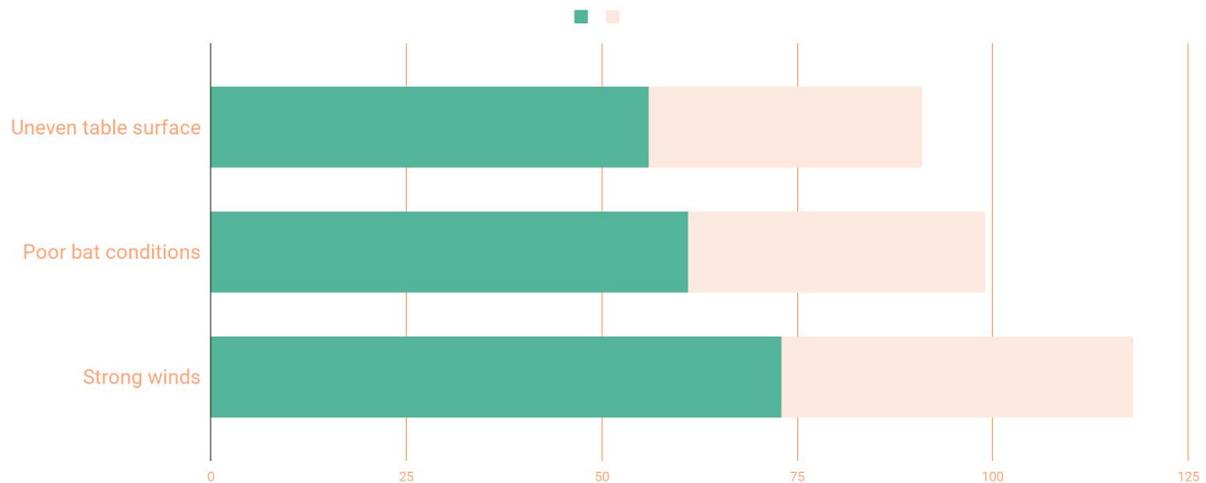


Fig 1.2

Fig 1.2 shows the results of our survey (only the top three results are shown)

According to the data from our survey, 73% of the respondents agreed that strong winds affect the game. This proves our assumption that strong winds have the most significant impact on the players.

Thus, the problem that we defined is: "Strong winds affecting table tennis gameplay in Hwa Chong." Our target audience is: Students in Hwa Chong who play table tennis.

1 B You should have selected a problem based on some considerations. Identify and justify these considerations.

Below are some questions we took into consideration when we were defining our problem and why they were necessary:

- **Consideration 1: How significant is the problem?**

Consideration 1A: How are people affected by the problem?

How people are affected by the problem defines how significant the problem is

Consideration 1B: How many people are affected?

The more people affected, the more significant the problem is, and thus there would be a higher need for a solution.

- **Consideration 2: Is there a need to solve this problem?**

Consideration 2A: Is there an existing solution to the problem?

If there is an existing solution to the problem, there is less need to solve it. Thus making the problem less significant and the solution to it less useful.

Should there be a solution:

Consideration 2B: How good is the existing solution should there be one?

If the existing solution is bad, we can still improve on it and create a better solution

Consideration 2B i: What is the cost of the existing solution

Consideration 2B ii: How effective is the existing solution?

1 C List some problems your group would like to solve. List also the considerations for selection of problems in the evaluation grid below. Score the considerations, against the problems, with points 1 (least significant) to 4 (most significant). Sum up the total points for each problem. Identify that problem you would like to solve.

Problem Evaluation Grid

	Possible problems:			
		Uneven table surface 	Strong winds 	Poor bat conditions 
Considerations for Selection of our problem	Describe the problem:	<p>The common reason for uneven table surfaces is because the floor is uneven. The uneven surface then results in the ball bouncing off the table in an irregular and unpredictable manner</p>	<p>In Hwa Chong, the tables are in the open. This means that there is nothing to shield strong winds. This results in the table tennis ball being blown off course, and thus making the game unfair.</p>	<p>Most of the bats that are provided by the PE department are often in poor conditions. Such conditions include: broken handles, broken paddles. This makes it harder for players to</p>

			and thus, making the game unfair.		use the bats.
How significant is the problem?	How many people are affected by the problem?		56% of the 62 people we surveyed, 35 said that they faced this problem when playing table tennis Score : [1]	73% of the 62 people we surveyed, 45 said that they faced this problem when playing table tennis Score : [3]	61% of the 62 people we surveyed, 38 said that they faced this problem when playing table tennis Score : [2]
	How are they affected?		Due to the uneven tables, the table tennis balls will bounce in an unpredictable way, making it hard for the players to play properly. Score:[2]	The strong winds can blow the table tennis balls to a different direction, making it hard for the players to play properly. Score: [2]	The bats are harder to use due to their defaults. The ball may also bounce off the bat irregularly due to the floppy padding. Score: [2]
Is there a need to solve this problem?	Is there an existing solution?	Describe the solution (if there is an existing one):	Yes. The anti-wobble table stoppers can be placed beneath the table legs to stabilize the table on uneven ground	Yes. However, the existing solution is not specifically built for the dimensions of a table tennis table. It is used to block strong winds (specifically	Yes. The re-fix glue can glue the loose rubber padding back onto the bat, or glue the wooden handle back onto the bat. This

				for a picnic)	enhances the quality of the bat.
					
		Pros:	It can stabilize the table	It is thick and durable and can last a long time.	The player's control over the ball while playing will increase.
		Cons:	It is easily moved along with the table, causing the table to uneven again.	Something is needed to stabilize the windblocker if not it will fall over.	The bat's rubber will wear out faster when the glue is used a lot of times on the bat.
		Score:	[2]	[3]	[1]
How good is the existing solution?	What is the cost of the existing solution?		The solution would not be too expensive if we just use recyclables to be placed beneath the table's feet instead of purchasing the proper equipment	The solution would not be too costly if we only use cheap materials like clothes and poles instead of buying proper equipment like the windblockers.	The re-fix glue is quite expensive, for people who do not want to spend too much money on table tennis, this option is not suitable. Around

			to fix the uneven tables. Around \$1-5 Score : [3]	Around \$7-10 Score : [2]	\$10-20 Score : [1]
		How effective is the solution?	The solution works decently, but one possible problem is that if the table is moved, the anti wobble table stoppers will move as well causing the table to be uneven again. Score : [2]	The dimensions of the existing solution is not specifically made to fit the table tennis table. Thus, it is unable to block all of the wind. Score : [3]	We researched for opinions of this product online and many people reviewed it as “very useful” and gave 5 stars, in fact of the four reviews shown on the website, every single one gave five stars. Score : [1]
Total Score:			[10]	[13]	[7]

Fig 1.3

Fig 1.3 shows the most significant problem with the most feasible solution is the strong winds problem.

Define the Problem

Now that the problem has been identified. It is important to gather information on the extent of the problem and/or evaluate the usefulness of existing solutions based on *some criteria*. You may need to conduct surveys and research on existing solutions.

2 A Extent of problem (Research and discuss the problem and write down the problem statement)

We surveyed 62 students, who play table tennis in Hwa Chong, from various levels and classes asking what problems they faced when playing table tennis. The results are as follows:

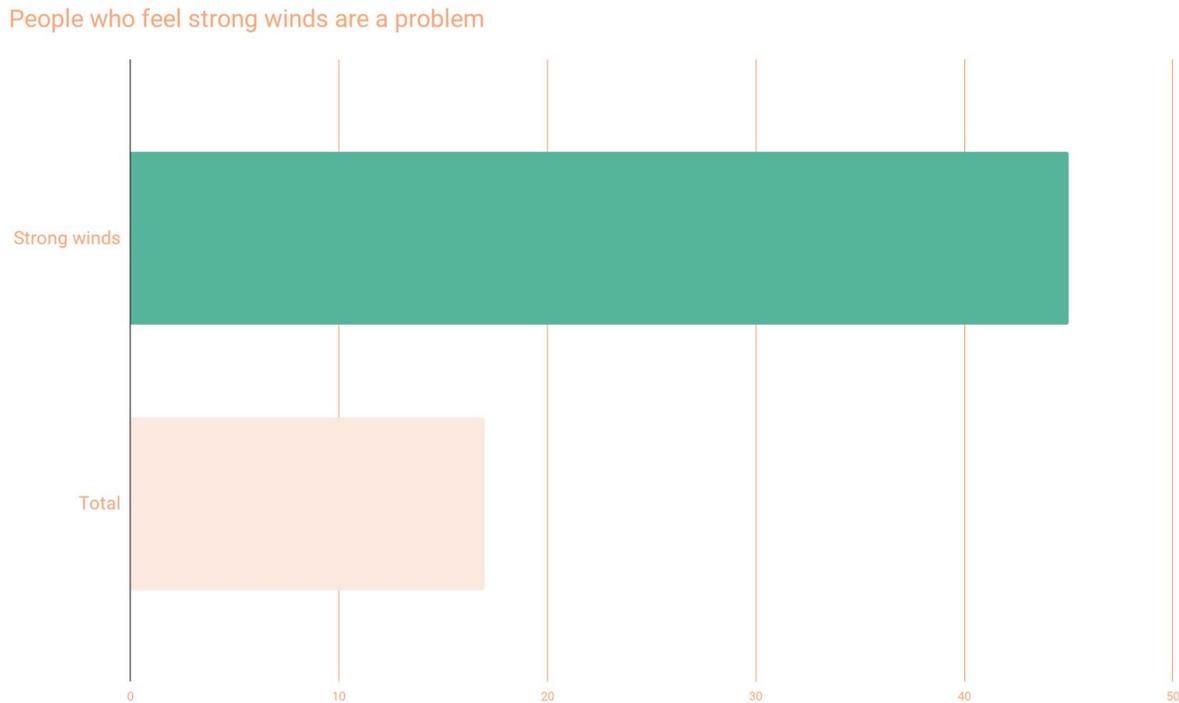


Fig 2.1

Fig 2 shows a chart of students who agree that strong winds affect table tennis games

73% of 62 students, who participated in our survey, said strong winds was a problem they faced, and a large number of people played table tennis

We then asked such students, who felt that strong winds make table tennis gameplay unenjoyable, if they continued to play table tennis despite strong winds. The results are as follows:

Would you continue playing with strong winds?

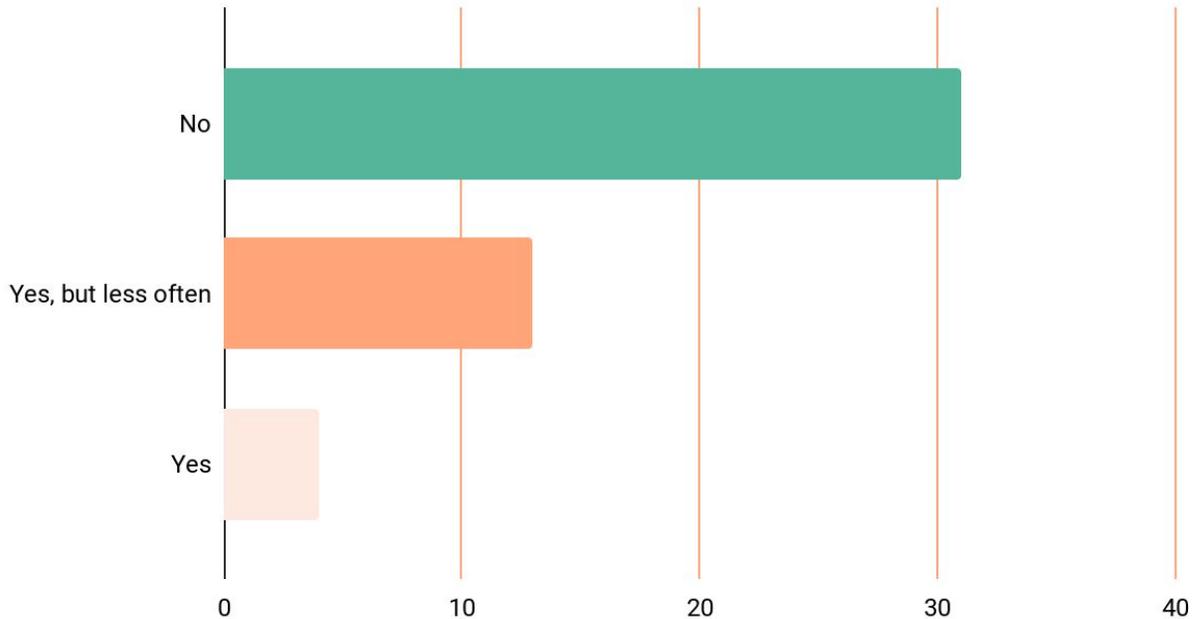


Fig 2.2

Fig 2.2 shows the results from our survey showing that strong winds affecting table tennis gameplay can result in less people playing table tennis

From the results above, it can be seen that strong winds affecting table tennis gameplay results in most students stop playing table tennis at all or students playing table tennis less often.

Thus, we have our problem statement: Strong winds makes table tennis games unfair and thus no longer fun or enjoyable. This makes many Hwa Chong students not want to play table tennis in school.

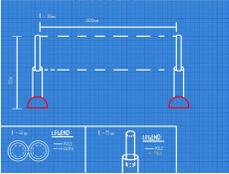
2 B Compare and contrast the existing or similar solutions.

The existing solutions include a picnic windblocker, a windshield, and a beach windblocker.

In the table below, we compare the existing solutions to our own solution. We compare them in terms of:

- **Compactability**
 - **Our target audience is students playing table tennis in Hwa Chong**
 - **The table tennis tables that are mainly used are located near the canteen**

- This is because the canteen is not on the same level as the classes
 - The product that we make needs to be easily moved from location to location as well as up and down the stairs
 - Although our target audience is specifically students playing table tennis in Hwa Chong, in the future, if our product is well-received, we would like to branch it out to others
 - We would want others to be able to easily bring our product around
 - Thus, the need for compatibility to ensure that our product can be easily moved.
- **Weight**
 - Following the previous point, our prototype would often be moved from location to location
 - Thus, we would want it to be as light as possible to ensure that the prototype can be moved effortlessly
- **Affordability**
 - Our target audience is students playing table tennis in Hwa Chong
 - Therefore, our solution must be as cheap as possible to ensure that it is affordable for students from different backgrounds
- **Durability**
 - Our solution is used to block strong winds
 - Thus, we need it to be durable enough to withstand the strong winds that it faces without breaking or getting torn
 - We want to ensure that the people who buy our solution, are able to use it for again and again
 - Thus, our solution also has to be durable enough to be reused multiple times

Existing solutions:	<p>Picnic windshield</p> 	<p>Beach windblocker</p> 	<p>Windblocker</p> 	<p>Ours</p> 
DESCRIPTION	Actual size : 14cm by 6cm (for table would need to be 150cm by 300cm)	Includes wooden poles	Has to be hung from a high area to block wind	Specifically built for a table tennis table

Compact	Foldable (but if increased in size is not compact) [2]	Poles are not compact [1]	Compact [3]	both poles and cloth can be contracted [4]
Weight	approx. 1540g [2]	approx. 1300g [1]	Negligible [4]	1000g TO 2000g [3]
Affordability	\$12 [3]	\$36 [2]	\$430 (includes front section to hang from) [1]	\$9 - \$11 [4]
Durability	wear resistant [4]	quite durable (double stitched) [3]	not very durable [1]	Not very durable due to low budget for materials [2]
Total score:	[11]	[7]	[9]	[13]

Fig 3

Fig 3 shows that our solution is the best solution to the problem

Your BIG IDEA

Developing the idea ...

Write down your proposed invention and why you want to do it. State also how you think your proposed invention is better.

3 A Describe your proposed invention.

We want to make a wind blocker specifically for table tennis that is compact, light, affordable and durable. Below, we have added our designs. Refer to the picture below

3 B Explain the purpose of your proposed invention and the potential benefits to users.

The purpose of our invention is to reduce the impact of wind on the table tennis game by blocking it. This would make the table tennis gameplay more fun, fair and enjoyable.

3 C In what ways would your proposed invention be different and/or better than existing solutions, if any?

Our proposed invention is:

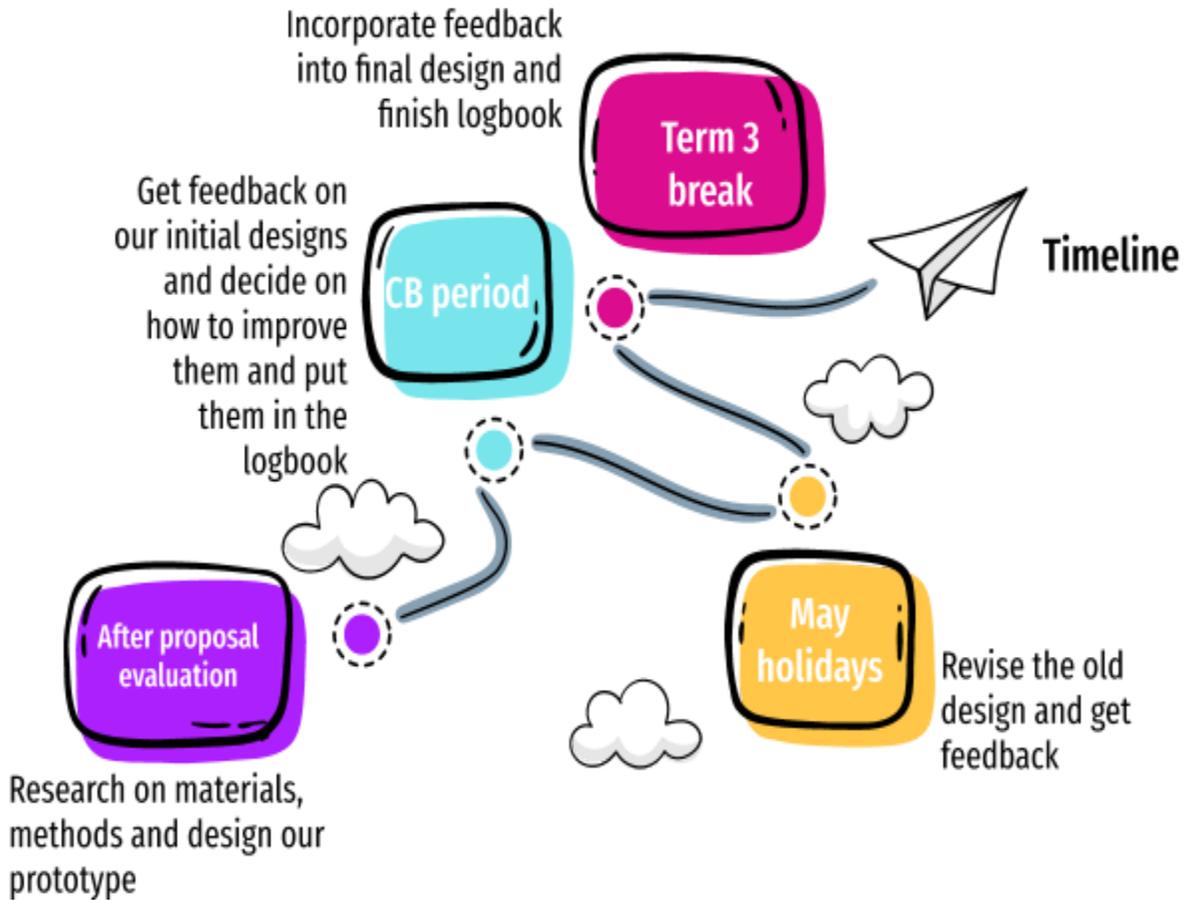
- **Specifically made for Table Tennis tables in terms of size**
- **It is able to be contracted to allow easy movement**
- **Lightweight so it is can be transported around easily**
- **Affordable for students (meaning that it should be affordable to most people)**

3 D What are some problems you expect in the course of your proposed invention?

Some problems we expect to face are:

- **Finding materials that are both durable and affordable**
- **Ensuring that the prototype can stand upright**
- **Ensuring that the prototype can be contracted**

3 E What and when are the major milestones (project timeline) in your invention?



Construction or Modelling Process*

This first ... then that ...

You are now onto the fabrication of your prototype/ product. You need to select material and understand how to put them together so that your prototype/ product can perform its function.

4 A Explain how and why the materials were chosen for the prototype/ product of your invention

We created a list of possible materials for each part and compared them with a table:
Cloth:

- Cotton
- Denim
- Polyester

Type of cloth:	Affordability	Durability	Weight	Flexibility	Total score:
<p>Cotton</p>  	<p>Based on the fabricstoreonline.com, cotton is \$12 per meter. Cotton is one of the most inexpensive and common materials.</p> <p>[3]</p>	<p>Among natural fibres, cotton is strong, but is nothing compared to synthetic fibres like polyester. Cotton is not waterproof and can be teared when wet.</p> <p>[1]</p>	<p>Negligible (Difference in a few grams does not make a big difference to its weight)</p>	<p>Cotton has relatively good flexibility, however, once stretched, it may not return to its original length.</p> <p>[2]</p>	<p>[6]</p>
<p>Denim</p>  	<p>Based on the fabricstoreonline.com, denim is \$22 per meter.</p> <p>[2]</p>	<p>Denim is a sturdy, durable, woven such that it can be effortlessly worn in rough conditions. The durability comes from the weave known as twill weave. Denim is usually a natural synthetic blend. Denim, like cotton, is not waterproof</p> <p>[2]</p>	<p>Negligible (Difference in a few grams does not make a big difference to its weight)</p>	<p>While denim is not flexible, the existence of stretch denim, which incorporates a bit of lycra into the blend, makes it more flexible, however it is still not flexible.</p> <p>[1]</p>	<p>[5]</p>

<p>Polyester</p> 	<p>Based on the fabricstoreonline.com, Polyester is \$26.60 per meter.</p> <p>[1]</p>	<p>Polyester is the most long lasting and durable fabric. It is a synthetic fiber, engineered to be stronger and more flexible than natural fibers, such as cotton. Polyester is known for being wrinkle resistant, durable, and good at retaining color dyes.</p> <p>[3]</p>	<p>Negligible (Difference in a few grams does not make a big difference to its weight)</p>	<p>Polyester is a very stretchable fabric, that is more flexible than cotton</p> <p>[3]</p>	<p>[7]</p>
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Fig 4.1

Fig 4.1 shows that Polyester is the best fabric by a narrow margin. It is the cheapest, durability is most suitable for our design and is the lightest.

Poles:

- Metal
- Plastic
- Wood

Type of pole:	Affordability	Durability	Weight	Ability (Is this material the most able to perform the function we want it to?) How	Total score:
Metal pole	<p>Metal is expensive, a metal pole on amazon costs about 21 dollars</p> <p>[1]</p>	<p>Metals tend to be stronger, harder and more durable, moreover, it is heat resistant. However it is important to note that such durability is redundant.</p> <p>[3]</p>	<p>Metals are significantly heavier than wood and plastic.</p> <p>[1]</p>	<p>We would be able to make two metal poles that can slide up and down such that it can contract.</p> <p>[3]</p>	<p>[8]</p>

Plastic pole	Plastic on the other hand is cheap and widespread, a plastic pole on amazon is about 8 dollars. [3]	Plastic is generally weaker, and has limited wear resistance, but is still durable and strong enough to serve as a frame. [2]	Plastics are significantly lighter than metals [3]	We would be able to make two plastic poles that can slide up and down such that it can contract. [3]	[11]
Wooden pole	Wood is in the middle of the two, with a wooden pole on amazon costing about 17 dollars (with connecter.) [2]	Wood is generally stronger than plastic but is not waterproof and will soften when in contact with water [1]	Wood is lighter than metal, but heavier than plastic [2]	We would not be able to place a wooden pole in another wooden pole without custom made hollow poles, it would be difficult to make it contractible [1]	[6]

Fig 4.2

Fig 4.2 shows that Plastic is the cheapest, plastic's durability is most suitable for our design and plastic is the lightest.

Thus, the material we choose to use for our design is plastic.

Base:

- Metal
- Suction cups

Type of base:	Affordability	Durability	Weight	Ability (Is this material the most able to perform the function we want it to?) How much force can this material support? This is to ensure that the base that we are using is	Total score:
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				strong enough to counter the strong wind.	
Metal Base with weights	<p>The metal base combined with the weights (close to \$7 for a 1kg weight) is around \$8-10</p> <p>[1]</p>	<p>Metal bases should be more durable than suction cups as metal is a tougher material that will not spoil easily.</p> <p>[2]</p>	<p>With added weights definitely very heavy</p> <p>[1]</p>	<p>Assuming we use a metal base weighted with 1kg it has about 10N of force, 2kg is 20N and so on.</p> <p>[1]</p>	[5]
Suction cups	<p>To cover our 2 bases we need at least $4 \times 2 = 8$ (4 for each base)suction cups which is approximately \$4-6 as seen by online prices</p> <p>[2]</p>	<p>Suction cups are usually made of highly flexible materials like PVC plastic or neoprene, these materials are preferred to natural rubber because they are stronger and more resistant to sunlight, abrasion and temperature extremes. They are pretty tough but not as good compared to metal.</p> <p>[1]</p>	<p>Based on Amazon, a packet of 6 suction cups with hooks is only 44 grams, making it 7 grams each</p> <p>[2]</p>	<p>The strength of a suction cup is calculated with $F = AP$ F being holding force ,A is the area of the suction cup and P is atmospheric pressure which we can take to be approximately 100000Pa. Assuming the suction cup has a radius 2cm, the force is 280N. Equivalent to 28kg.</p> <p>[2]</p>	[7]

Fig 4.3

Fig 4.3 shows that suction cups would make a more suitable base

4 B Explore these considerations that may guide the construction of your prototype/ product.

- Must be compact
- Must be durable enough to withstand strong winds
- Must be made of affordable materials
- Must be easy to set up and use

4 C Document the prototype/ product development stages. You may use drawings, photographs or videos.

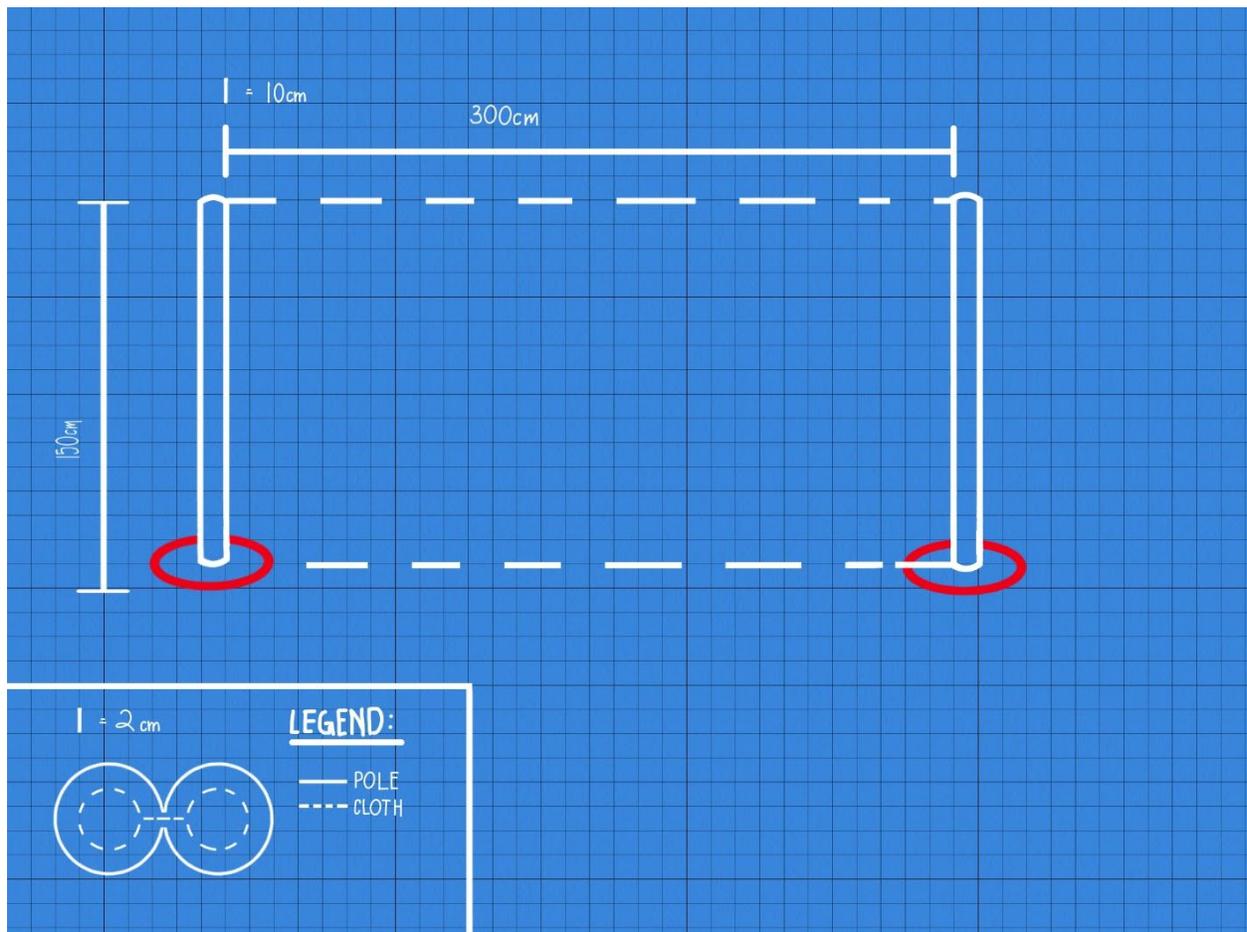
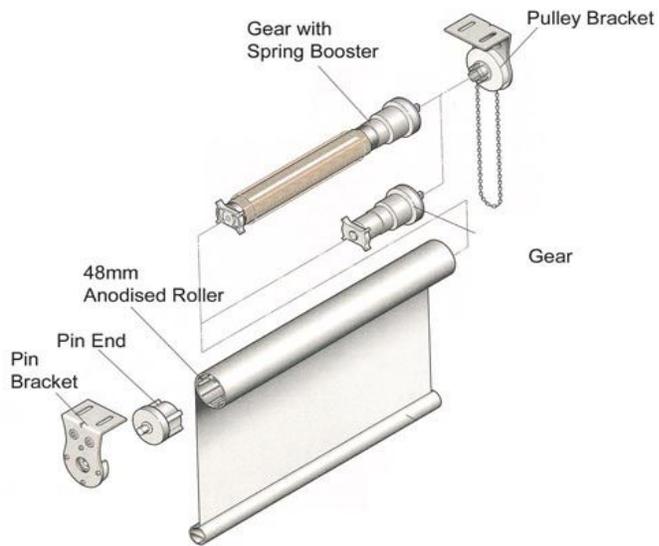


Fig 5.1

Fig 5.1 shows our first proposed design. It works similarly to how a projector screen would work.



We made a small model that shows how the contractible cloth would work, as seen in the pictures, the cloth(represented by the paper) can be extended and clipped on to another pole, once we are done, it can be retracted into the first pole making the invention compact.

The cloth could be rolled up inside of the poles when not needed. Thus, making our product contractible.

However, we felt that the design wasn't good for a few reasons:

- Our prototype couldn't be compacted vertically but only horizontally
- This means that our product was not compact enough as in its most compact form, it would still have a height of 150 cm
- Thus, we surveyed multiple students and asked them if they shared our views
- The results are as follows:

Feedback for our first design

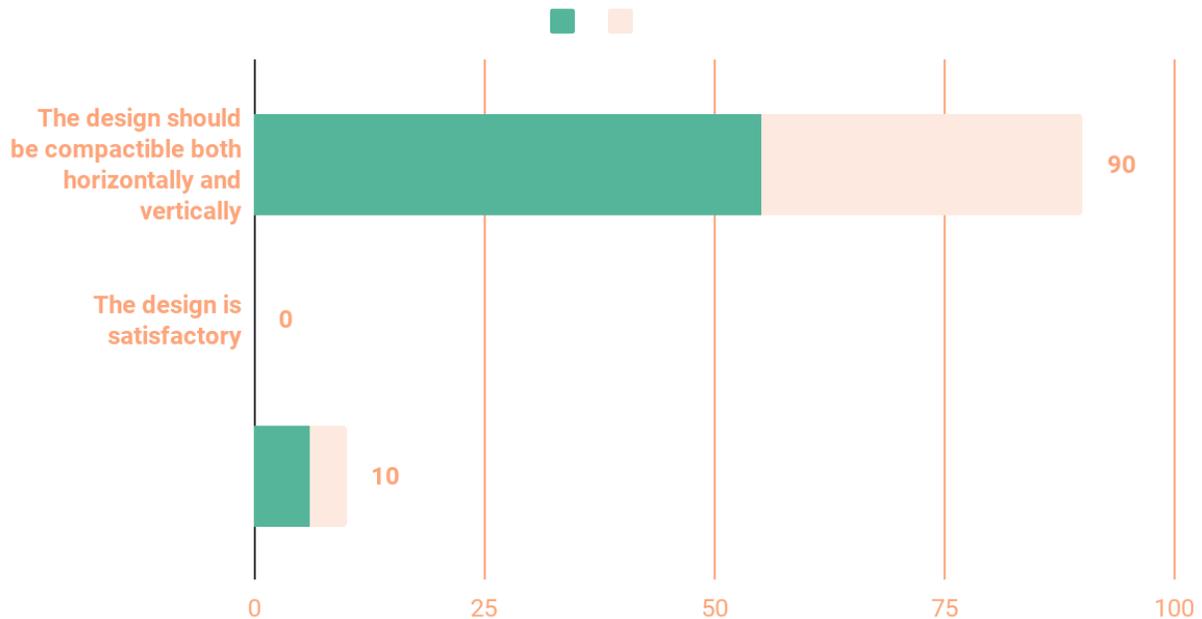


Fig 5.2

Fig 5.2 shows that out of the surveyed 61 students, about 9 in 10 students agreed with us that the design should be able to contract both vertically and horizontally. 1 in 10 students surveyed felt that the product was satisfactory. Thus, from the results, it can be seen that most of the students agreed with our views. Thus, we came up with a second design.

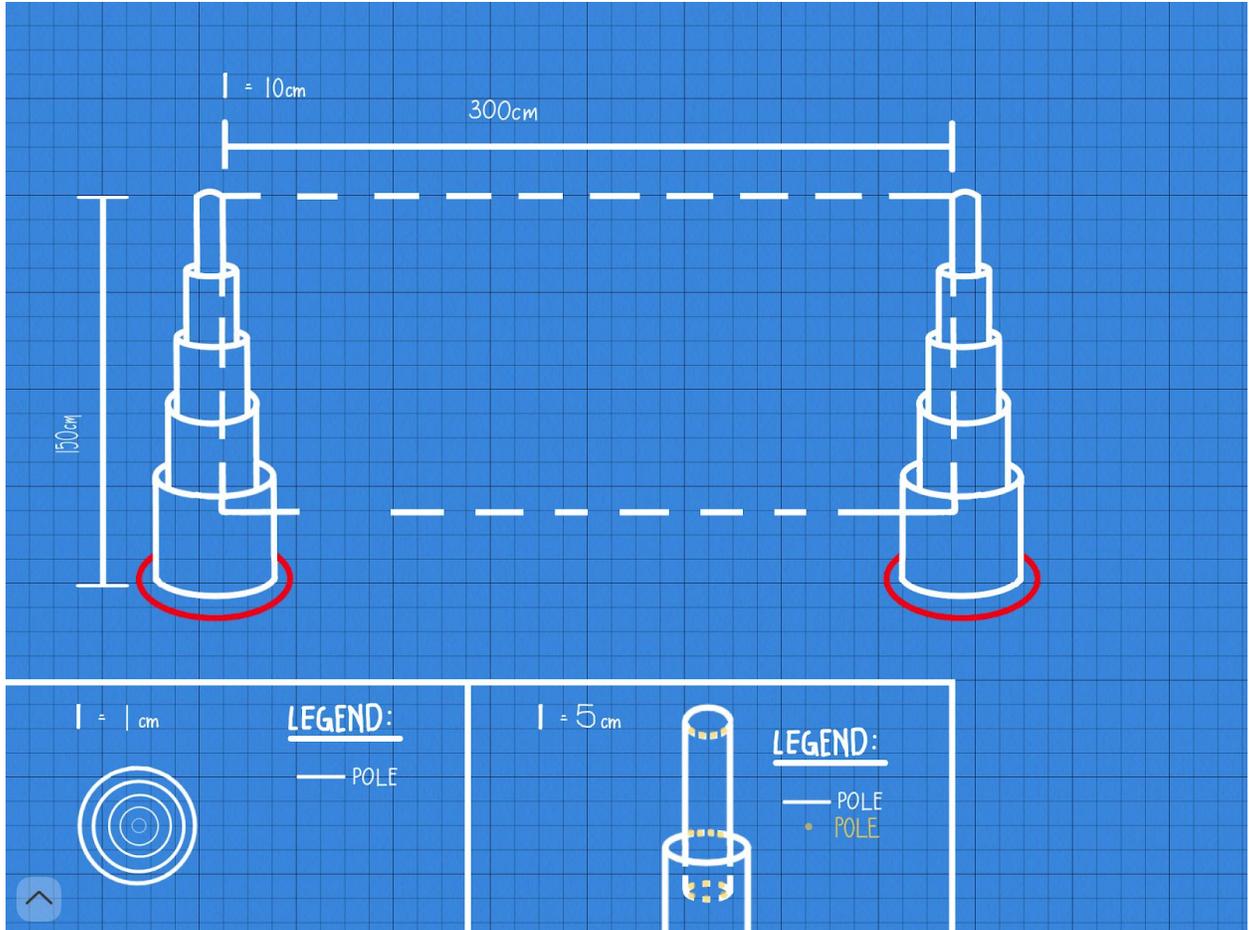
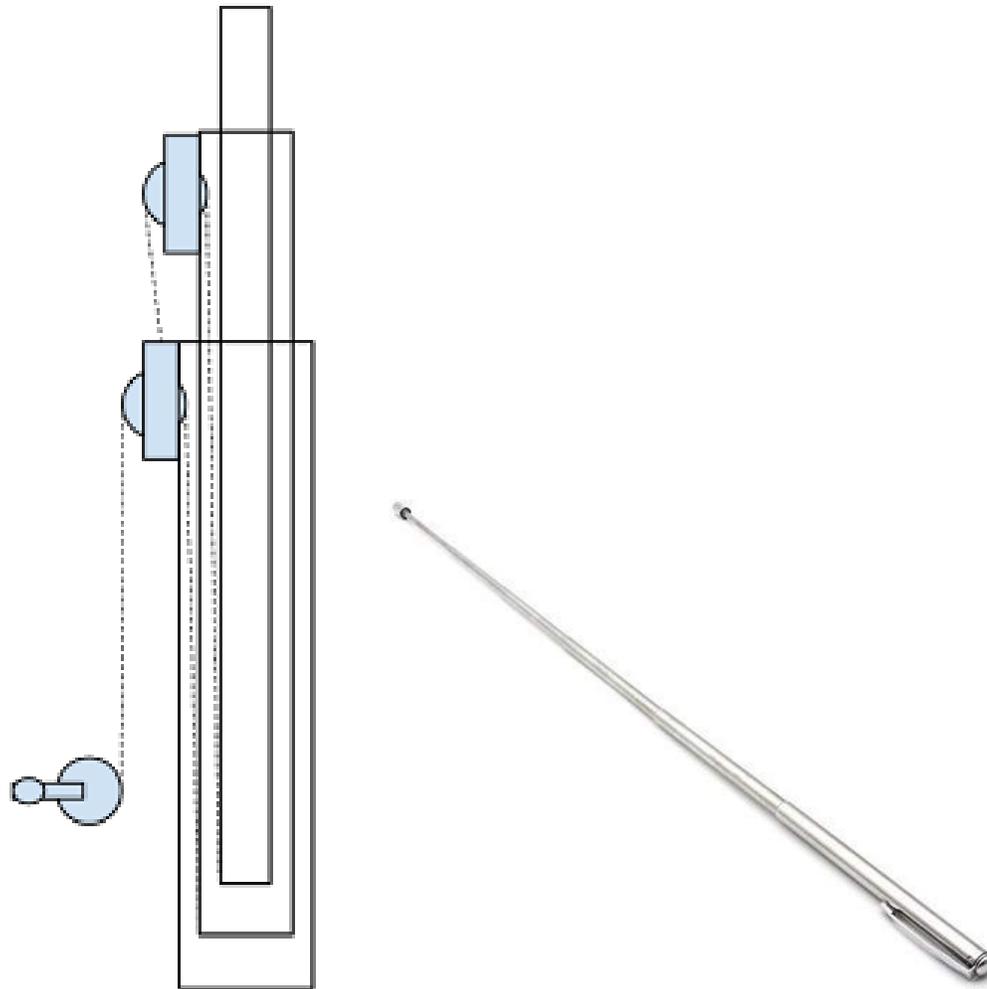


Fig 6.1

Fig 6.1 shows our second proposed design. This pole of this design works like an extendable pointer .



The poles can be contracted vertically. The cloth is detachable from the poles and attached to it by velcro. This makes the design contractible vertically and horizontally.

However we were dissatisfied with some aspects of the design:

- **We felt that there were too many poles (used to make up the bigger one)**
- **This made the pole design too thick and therefore not as compact as we would like it to be**
- **Besides, we were also unhappy with the cloth aspect of the design**
- **As the cloth, in our design, is detachable, we feared that students may lose the cloth**
- **Thus we surveyed 62 students to see if they shared our views**
- **The results are as follows:**

Feedback for our second design

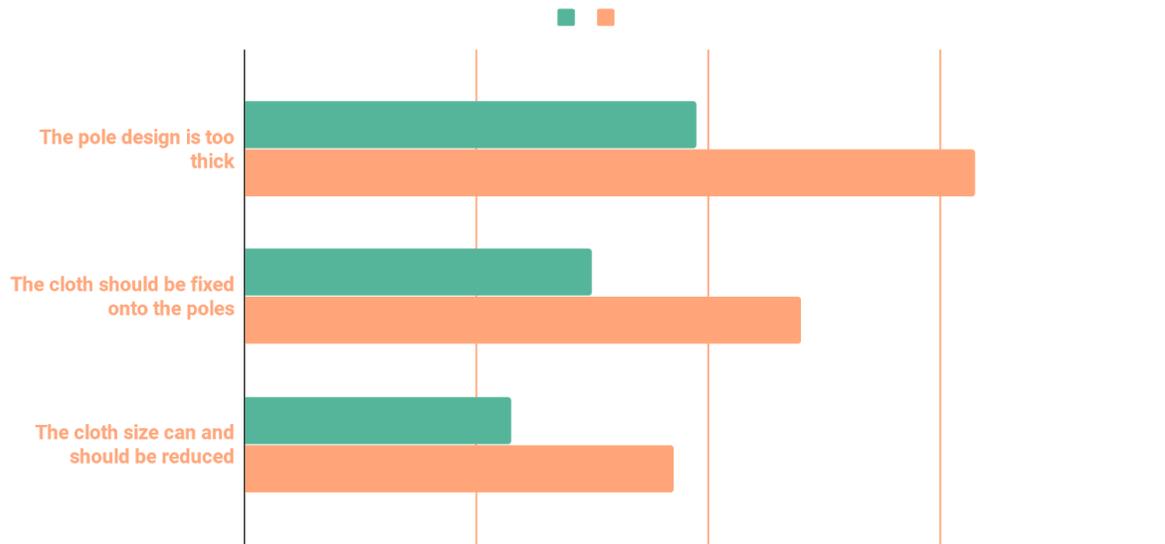


Fig 6.2

Fig 6.2 shows that out of the surveyed students, 63% of a total of 62 agreed with our views that the pole design was too thick and the number of poles (used to make up the bigger one) should be reduced. 48% of the students who we surveyed also agreed that the cloth should be fixed onto the poles to ensure that the cloth does not get lost. Not only did the surveyed students agree with us, 37% of the surveyed students also suggested that the cloth size could be reduced. They said that the cloth size was unnecessarily big as the strong winds only affect the gameplay on the table and not below it. Thus, they suggested that we reduce the cloth size to make the design cheaper, lighter and more compact. Thus, we came up with the third design.

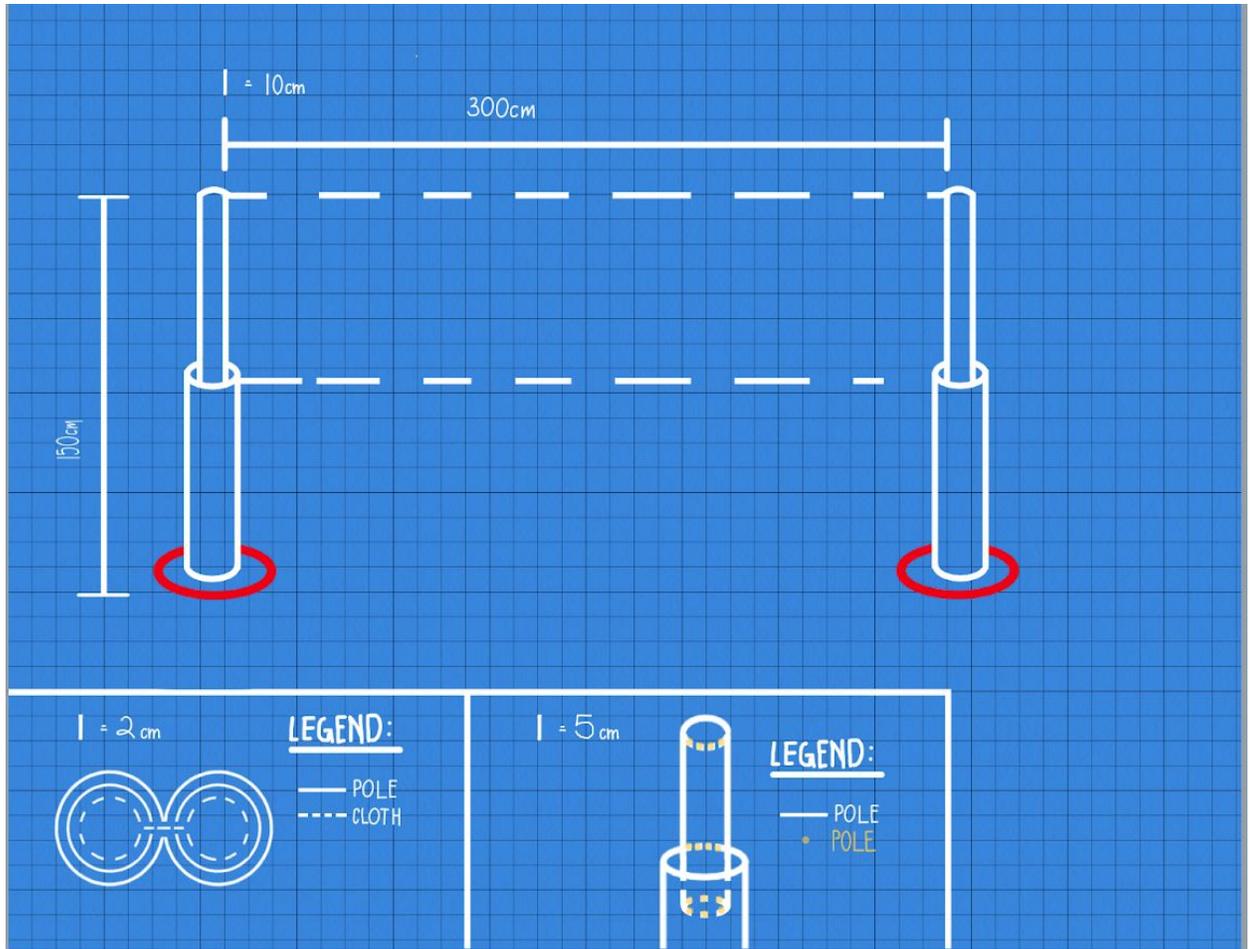


Fig7.1

Fig .1 shows our third proposed design. It functions like both of the previous designs. The poles function like the second proposed design poles. The top pole functions like the poles of the first design. This made our design compact both vertically and horizontally while keeping the cloth fixed onto the pole. This also reduced the cloth size.

Initially, we agreed that this design had no flaws. However, before creating a survey to ask students on their opinions, we realised that we could change the design's base into a suction cup. Suction cups could perform the function of a heavy base but it would make the design weigh less. Thus, we decided to replace the base of the third design before asking students for their opinions.

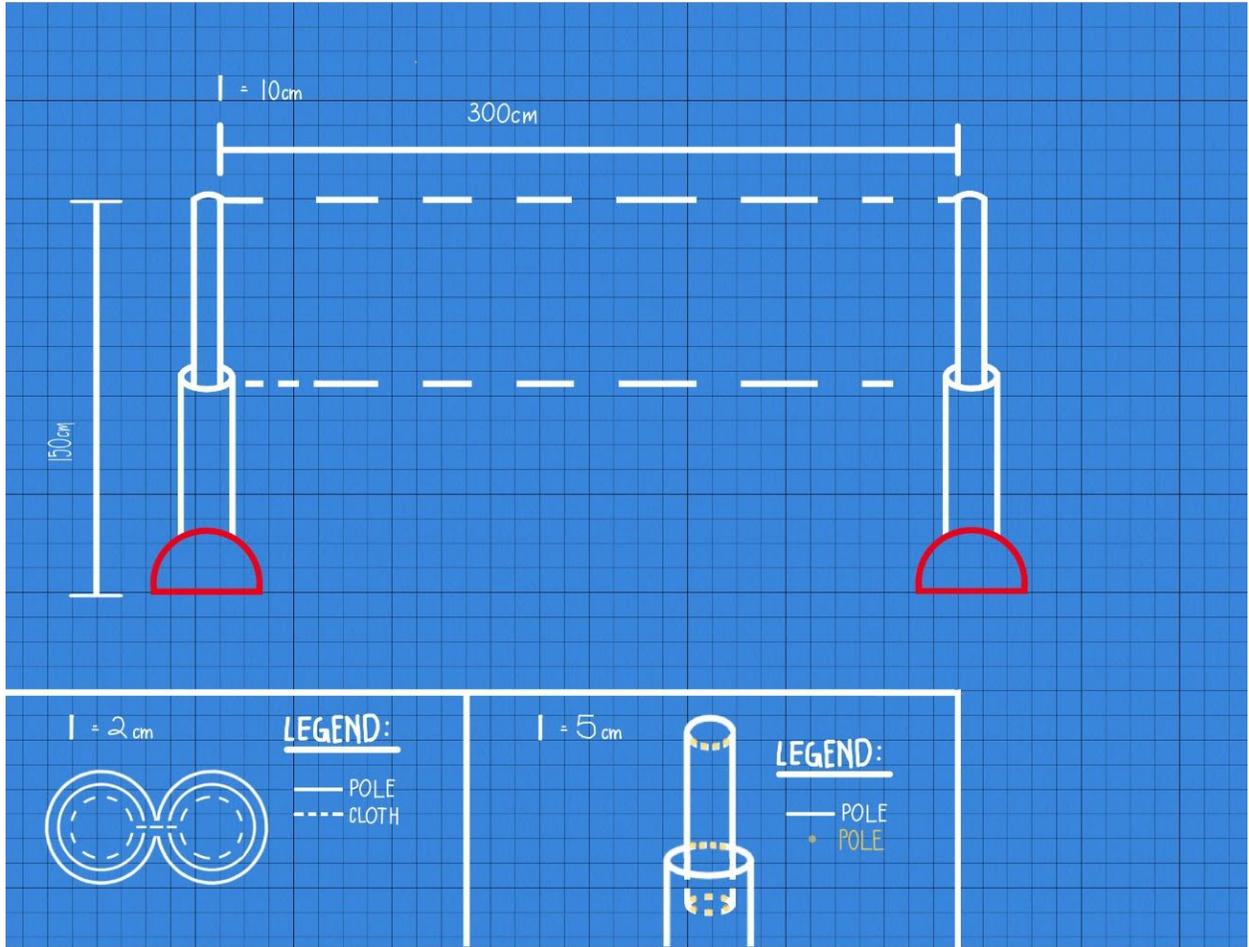


Fig 8.1

After changing the design to the one above, we created a survey comparing the previous two designs asking students which one they felt was better. The results are as follows:

Comparing Design 3 and 4

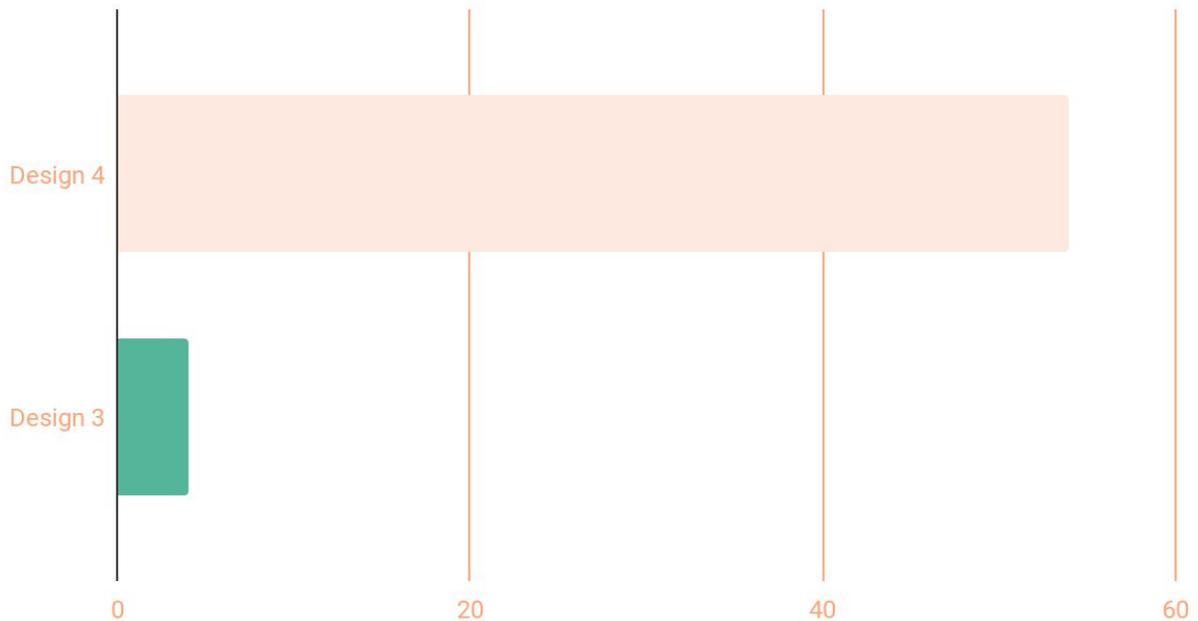


Fig 8.2

Fig 8.2 shows that of the students surveyed, most of the students agreed with us. Of those who did not, they were concerned that using the suction cup as a base might not be the best option. As they felt that the suction cup may be inefficient on rough ground. This was one point we did not consider. However, in the context of Hwa Chong, the floor near the table tennis areas are relatively smooth. Thus, it should not affect the suction cups ability.



To make sure suction cups really would be strong enough to hold our product, we conducted an experiment. The suction cups were able to withstand the weight of a dumbbell, proving that it can be used to withstand strong winds. We thus chose the following to be our final design.

Some posters advertising our product:

GET OUR

TABLE TENNIS WINDBLOCKER

now



Created by Edwin PM
from Noun Project

LESS WIND . MORE FUN .

**A COMPACT, AFFORDABLE, LIGHT AND
DURABLE PRODUCT.**

TABLE TENNIS WINDBLOCKER



BLOCKS WIND

So that you can have a fun game
of table tennis!



CONTRACTABLE

Easy to keep and set up!



AFFORDABLE

Cheap and affordable for
students!



DURABLE

Doesn't break easy, one buy is all
you need!

With our table tennis wind blocker, your table tennis
games will be fun and wind free!

OR

If construction of the prototype is not possible, then you have to create an animation / as a proof of concept that it can be applied on a bigger scale.

4A Explain why construction of a prototype is not possible and the proof of concept is needed in your case.

Because of restrictions caused by COVID-19, it is hard to get together as a group because of the need for social distancing, thus, we are unable to begin prototyping together, thus we have decided to use a poster to convey our idea.

4B Briefly explain how the video / animation can effectively show how your invention will work and the different considerations.

We would use a A1 poster to showcase our idea and provide information on our processes and designs, this would show our thinking process for our idea which could be used to show that our idea is feasible and practicable, we would also show the materials used and why, which would further show how it is workable.

Warning:

*Video / animated simulation only if prototyping is absolutely not possible.
Video / animated simulation must be logical and convincing that the invention works.
Constraints must be clearly included in the logbook or the project will be heavily penalized.*

Modification and Evaluation

Upon the completion of your prototype/ product, you would need to see if it is working the way you want it to work. Check if your product has met the identified purpose and the user's need; and implement necessary modifications and improvements. This process may take several rounds.

5 A Write down your prototype/ product test criteria and check against it if it works. Identify areas of weakness for modification. Indicate the test iteration and date of test.

Test Iteration:	Tick			Remarks
Test Date: NIL	Pass	Fail	Potential Failure	
Able to contract horizontally	-	-	We might not be able to make the contraction automatic	Research on visualiser mechanism

Able to contract vertically	-	-	Should work	-
Able to stand and withstand strong winds	-	-	Suction cups may not be strong enough	We would have to add more suction cups

*Add more rows for more criteria

** Repeat table for next test iteration

OR if you are creating an animation / video to show how your invention will work, write down the different possibilities / outcomes [success or failure] if a full-scale prototype is to be constructed.

References

Read <http://www.bibme.org/citation-guide/apa/> on how to cite references.

6 A Cite the references you have used for your project work. Your source of reference should come from different types (eg books, magazine, websites, journal articles, interview, photographs, product brochure, reviews etc.)

Amazon.com: Uning Camp Stove Windscreen, 10 Plates Lightweight Folding Outdoor Picnic Cooker Stove Wind Screen Windshield for Camping Stove Backpacking Stove Butane Stoves Alcohol Stoves: Sports & Outdoors. (n.d.). Amazon.
<https://www.amazon.com/Uning-Windscreen-Lightweight-Windshield-Backpacking/dp/B01KCJJ4VE>

N. (2019, November 1). Wind Blockers turn your wind-out canopy into an awning. Retrieved from <https://www.caravanguard.co.uk/news/wind-blockers-turn-your-wind-out-canopy-into-an-awning-4183/>

M. (n.d.). Beach wind blocker – Specialist Car and Vehicle. Retrieved from <http://avtoprokat69.ru/beach-wind-blocker/>

The Fabric Store | Buy Quality Fashion Fabrics Online. (n.d.). The Fabric Store Online.
<https://thefabricstoreonline.com/>

Amazon.com: Online Shopping for Electronics, Apparel, Computers, Books, DVDs & more. (n.d.). Amazon. <https://www.amazon.com/>

N. (2019, November 1). Wind Blockers turn your wind-out canopy into an awning. Retrieved from <https://www.caravanguard.co.uk/news/wind-blockers-turn-your-wind-out-canopy-into-an-awning-4>