

Hwa Chong Institution Project Work

Category 3 Inventions Written Report

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#1 Problem Finding

Inspired by real life problems, we identified some issues such as bottles spilling, unstable tables and the potential problem of wheelchairs, We came up with these problems after witnessing real life incidents and coming across those problems in the news. After using a decision matrix (Fig 1.0), we narrowed it down to bottle spillage.

Especially in school, or high human traffic areas, where students and staff might be moving around a lot, accidentally knocking down someone's bottle is common. The spillage that could occur might damage books or papers. Studies have shown that "Worldwide, 780 million people do not have access to an improved water source".(Global Wash Fast Facts,2016). Water is precious.

Students use school desks to write, and they are often used so they are susceptible to wear and tear, which would cause the table to be unstable, or one table leg might be shorter than the other, giving students a hard time writing.

Wheelchairs might also cause problems as it might slip down a slope by accident and cause serious injuries to the user. Below is the criteria table we used to determine which problem to address. We felt that wheelchair-bound students might have trouble in those situations.

Considerations for Selection (Rated on a scale of 1 to 5)	Problems		
	#1 Spilling and toppling of drinks	#2 Wheelchair	#3 Unstable/Shaky tables
Cost of solving this problem (1 is very unaffordable, 5 is very affordable)	5	2	5
Is there a feasible existing solution? (Very unfeasible is 1, very feasible is 5)	4	3	3
Portability of potential invention (1 is very importable, 5 is very portable)	4	3	3

Total Score (out of 15)	13	8	11
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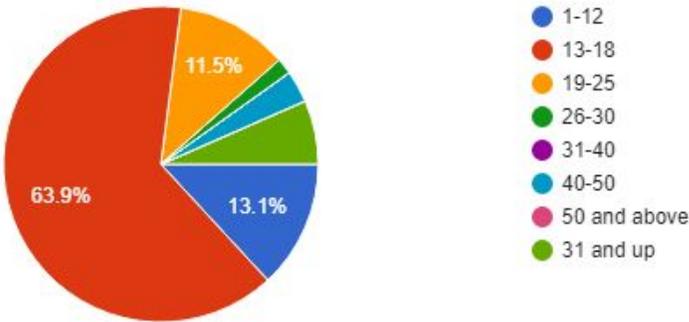
(Fig 1.0, Criteria table used to determine which problem to solve.)

#2 Define the Problem

We have conducted a survey (mainly on teenagers) to determine the frequency of our problem, not just in school, but partially in other locations as well. Below are the results. Based on our results, 53.2% of people spill water often, and 67.7% would use a product which would prevent spillage.

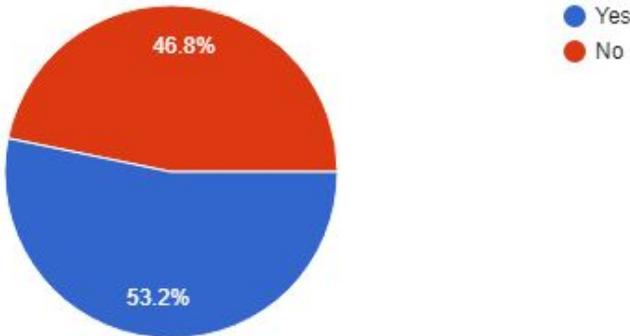
What is your age group?

61 responses



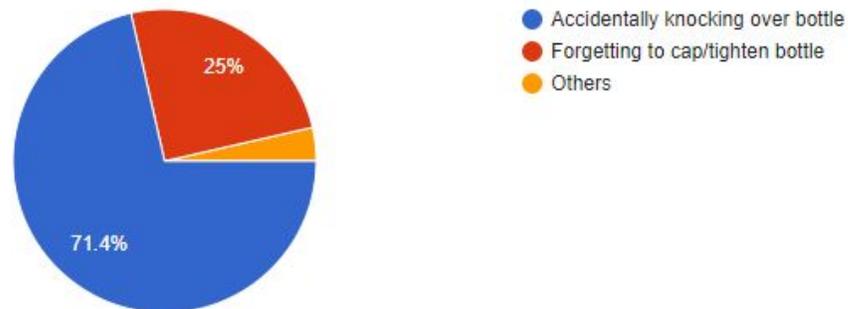
Do you accidentally spill water often?(at least twice a week)

62 responses



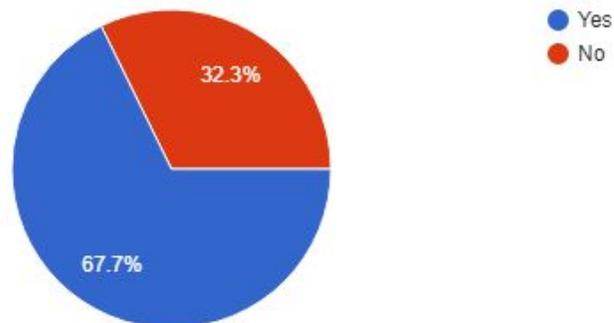
Under what circumstance do you usually spill water?

28 responses



If there was a bottle holder that could prevent your bottle from spilling, would you try it?

62 responses



Below are some existing products that we compared with our prototype. We have made an analysis (Fig 2.1) and criteria table (Fig 2.2) to determine how effective those products are at fulfilling the purpose of preventing water spillage.



Factory-Global Bottle Carrier



Accmor 'bike cup holder'



Coasters

Product	Pros	Cons
1. Factory-Global 1L bottle holder	<ol style="list-style-type: none"> 1. Removable strap, easy to carry 2. Thermal insulation keeps bottles warm longer 3. Soft, durable material is easy to clean. 	<ol style="list-style-type: none"> 1. Bulky 2. Heavy 3. Susceptible to wear and tear
2. Accmor 'Bike cup holder	<ol style="list-style-type: none"> 1. Can be fitted on cylindrical surfaces 2. Lightweight and Simple to install 3. Keeps the cup secure and safe from spills. 4. Good for bicycle, wheelchair type of vehicle 	<ol style="list-style-type: none"> 1. Bulky 2. Can only fit certain volumes of water bottles (1000ml) 3. Susceptible to wear and tear
3. Coasters	<ol style="list-style-type: none"> 1. Absorbs water from cold drinks 2. Stops condensation from reaching and dirtying the tabletop 	<ol style="list-style-type: none"> 1. Does not fully prevent the toppling of bottles

(Fig 2.1)

Product	How hard is it to topple? (1-5)	Versatility (1-5)	Mass of product (1-5)	Sturdy Base (1-5)	Total Score (max 20)
Factory-Global 1L bottle holder	2	4	1	3	10
2. Accmor 'Bike cup holder'	3	3	2	3	11
3. Coasters	1	2	5	1	9
4. Our product	4	3	2	4	14

(Fig 2.2)

#3 Your **BIG** Idea

Our invention is targeted at those who stay crowded areas for several hours. We aim to solve toppling and spillage of water bottles. We also want our invention to be portable and light, so that it is convenient for people. Our invention is a box-like contraption, which reduces the chance of water bottles being toppled. Our invention is made out of acrylic of 3mm thickness. The base measures 12cm by 12cm, whereas the area of the sides is 6cm by 13cm so that it would be portable. These measurements were decided with the view of our invention fitting most bottles. Our product features a box-like structure supported by metal hinges connecting the sides/walls to the base. The water bottle would be placed in our invention, where velcro straps attached to the sides will secure the water bottle, ensuring that it will not drop out of the invention. Under the base, there will be rubber surface to increase friction between the table surface (on which the invention resides) and the invention to prevent that it would not fall.

#4 Construction or Modelling Process

We have experimented and made 3 different products, improving each based on our product tests as well as comments from the judges.

Prototype 1: We used wood as our material as it easy to work with. Our prototype was a wooden box-like invention that reduced the chances of the spillage of water. A velcro strap was attached to one of side of the inside of the box , which could be used to secure the bottle to the box. The weight of box made the bottle unspillable. However, it was very easy to slide it off tabletops. Shown in Fig. 4.0 and 4.1.

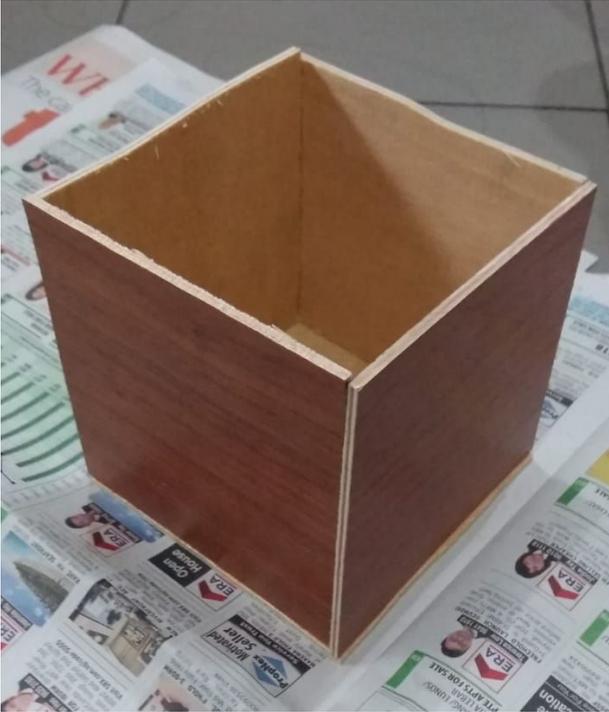


Fig. 4.0, outside view of Prototype 1.



Fig. 4.1, Interior of Prototype 1.

Prototype 2: At first, we thought of using wood for prototype 2 as it was easy to work with for prototype 1 and we thought it would be the same. However, we realised that wood was susceptible to wear-and-tear. Thus, we decided to use acrylic as it was more durable. We also modified the prototype according to the comments during mid term evaluation, which were that the invention was too bulky and it could not ensure that the bottle would not slip. Thus, to rectify this, we added hinges and made the prototype foldable. We did this by making the prototype such that when it opens up, it forms a net. Pertaining to the problem of the bottle slipping, we added foam to the bottom of the bottom of the invention as it was easily accessible and easy to work with. Shown in Fig. 4.2.

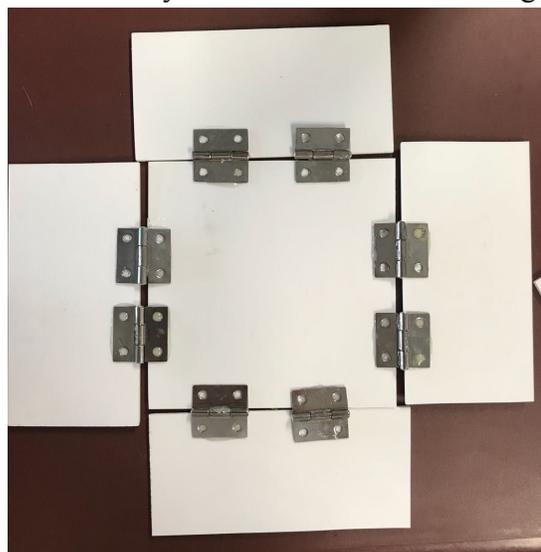


Fig. 4.2, Prototype 2 fully flattened into a net.

Prototype 3: After completing Prototype 2, we decided that we had sufficient time to brainstorm and make a third prototype. We realised that even though prototype 2 is not bulky when it is not in use and opened up, it would still occupy a considerable amount of precious space on a table when in use. We thus decided to reduce the base area of the new prototype.

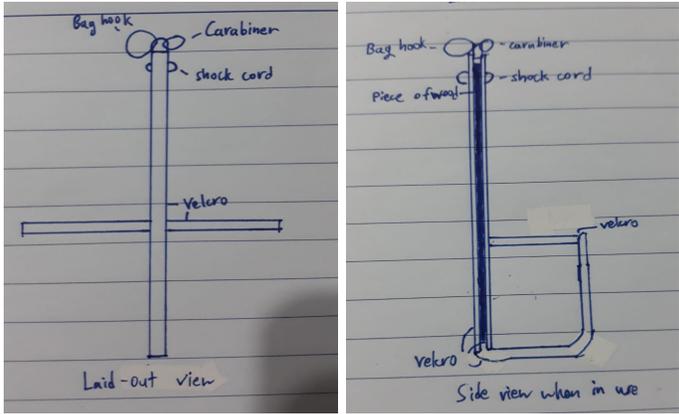
We received our inspiration from the humble diaper. The diaper needs to be secured firmly and quickly on the baby with a simple yet flexible locking system so that it does not fall off while the baby crawls, climbs or walks.

Using this idea from the baby diaper, we have designed this versatile locking system to fit the size and shape of an average hwa chong student. The Velcro strips are adjustable in width and height to fit most water bottles and to secure it firmly. This Sleek, simplistic design is suitable for those with an Active lifestyle. Which is the life style of every Hwa Chong student.

The specially designed carabiner allow you to hook your water bottle to your school bag. And we all know how difficult it is to find space in our school bag for our books, pencil box, laptop etc. With this cariberra you can easily hook your water bottle to your school bag. The addition of this specially designed carabiner allows you to hook your water bottle on any table surface, in the classroom, in the canteen, at any food court.

The velcro used for the main structure can be adjusted to fit the bottle size, thus maximising the use of much needed space in a high traffic flow area. We applied a piece of velcro along one full height of the bottle and a half-full length on the opposite side. The backing of the side with the full length of velcro with wood strengthens the structural integrity of the prototype. We added another piece of velcro around circumference of the bottle at the height of approximately two-fifth of the bottle to hold the bottle steady in place. To further ensure that the bottle does not fall out, a shock cord is attached to the top of the velcro running alongside the full height of the bottle.

We then came to the realisation that even though many improvements are implemented upon our new prototype, it fails to solve our problem: the spillage of water from the topping of bottles. The bag hook added enables the bottle to be hanged at the side of the table, with the bag hook clamping it firmly to the table surface. Shown in Fig. 4.3 and Fig. 4.4.



(Fig. 4.3, Laid out view of Prototype 3) (Fig. 4.4, Side view of Prototype 3.)

#5 Modification or Evaluation

Test Iteration:	Indicate X			Remarks
Test Date:	Pass	Fail	Potential Failure	
Almost completely immovable base		X		We plan to put rubber at the bottom of the base to increase friction between the box and the floor to increase the sturdiness of the box
Water resistance or waterproof		X		The wood isn't waterproof
Able to fit different sizes of bottles	X			The velcro strap is adjustable and is able to fit different sizes

From the mid-term evaluation to the final evaluation, we have made a significant change to our invention. The first modification that we made was the complete change of material. We used acrylic in the final product instead of wood, as we felt it was a better material choice. This was because we found that after dropping the invention a many times, the wood would start to chip away. Thus, we decided on using a stronger material that would be longer-lasting, more durable and impact resistant.

The next modification that we made was the height of the product, in order to make it more portable, we halved the height of the original product, and used that height as our final product, The next modification we made was the addition of the non-slip material on the bottom of the base. As we felt that the invention was not sturdy enough to prevent the bottle from toppling, we have decided to increase friction between the invention and the surface it is on using non-slip material. This will decrease the chance of the invention being knocked over due to the increased amount of friction on the bottom of the bottle holder. All these modifications were made according to the comments that the judges made after the mid-term evaluation which were: Invention too bulky, not portable enough.

The final modification and prototype we made was something very different, and it involved a completely

#6 References

Market Analysis

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