

# 1. Deciding of problem to work on

## 1.1 Listing of problems

Our group came out with four problems that we feel are causing inconvenience or discomfort to people around the world now. The problems we came out with are first, Dementia patients being lost in their surroundings often, books being unable to stand upright, papers being wasted after writing a few sentences and students having heavy bags. These problems were listed and a few considerations were applied such as the possibility of solution, the number of people that are facing this problem and the time and effort put into the project for a year. We also had to evaluate the possibility of the product and what specific impact will our product cause. We came up with a decision matrix to evaluate these problems fairly.

## 1.2 Choosing of problem to work on

Decision Matrix

| Problems(maximum 5 points for each problem)   | Consideration #1-Possibility of idea | Consideration #2-No. of target audience | Consideration #3-Worthiness of time and effort | Total Score |
|---|--------------------------------------|---|--|-------------|
| *Number of points allocated to each problem will be multiplied by the points rated for each consideration | 5 points                             | 4 points                                | 3 points                                       |             |
| Students having heavy bags  | $4 * 5 = 20$                         | $5 * 4 = 20$                            | $4 * 3 = 12$                                   | 52          |
| Dementia patients   | $3 * 5 = 15$                         | $4 * 4 = 16$                            | $5 * 3 = 15$                                   | 48          |
| Papers being wasted   | $2 * 5 = 10$                         | $5 * 4 = 20$                            | $5 * 3 = 15$                                   | 45          |

After our detailed evaluation of the problems, we have decided to work on the problem of students having heavy bags and we hope to resolve this problem.

# 2. Introduction

## 2.1 Background

Students' bags are increasing in weight due to the number of textbooks and other academic related stuff. According to two surveys which were conducted \* (by who, more than half the students have mentioned that they carry heavy bags to school often and find it exceptionally tiring with their shoulders aching very often. Another survey shows that more than half the number of students have shown that they do hope to have an economical and useful solution for the problem of the heavy bags. Hence, we decided to come out with a product which reduces the weight on students' shoulders while they can still bring whatever they need.

## 2.2 Identification of the source of problem

Therefore, we, the team, searched for the source of the problem and we listed a few different causes of the constant shoulder and back aches. Firstly, it was due to gravity pulling down the bag which contains too many academic stuff, causing the students' shoulders to suffer the pressure of the bag, aching. One solution to solve this problem in a cheaper and easier way is to sort out when to bring what books. However, in our survey conducted to more than 100 secondary and primary school students, many have expressed that this method caused many students to forget items and end up getting chided by their teachers. This has been a worry for the students as they feel pressured by the constant need to carry heavy bags or to pack more than what they needed to bring. It turns into a dilemma.

## 2.3 Substantiation of the problem

Studies have shown that many problems can result from carrying heavy bags which include disformations of the musculoskeletal such as having the spine tilted to one side when the children carries the bag on one side, bad postures such as crouching and fatigue, aches and strains and most importantly that the heavy bags put a pressure on the lungs, causing a reduced breathing lung capacity which causes great decrease in stamina and difficulty of breathing in time to come..(Saraswat 1) Hence, we can conclude that the heavy weight of bags has a very serious impact on a child's future and growth.

## 2.4 Solutions to the problems

Our group have thought that less pressure would only be applied to the shoulders if gravity could be opposed, if the weight could be applied evenly to other parts of the body or if the bag had sponges which could reduce slight pressure. According to the above stated methods, we came out with a product for each of the methods. The products are as such, they are (#1)a gadget with a belt around the waist attached to a platform slightly above the butt which can spread the weight to the rest of body, (#2)a bag with straps around the waist ,chest and to the stomach, (#3)a gadget which has lots of sponges with the correct posture and can be attached to the bag, to reduce cost.

## 2.5 Choosing of solution

As our group was in a dilemma, we used a decision matrix to choose wisely.

| <b>Products</b>                   | <b>Affordability</b> | <b>Originality</b> | <b>Usefulness</b> | <b>Total Score</b> |
|-----------------------------------|----------------------|--------------------|-------------------|--------------------|
| <b>#1 Gadget to spread weight</b> | 4                    | 5                  | 5                 | 14                 |
| <b>#2 Bag with triple straps</b>  | 3                    | 2                  | 4                 | 9                  |
| <b>#3 Gadget with sponges</b>     | 4                    | 3                  | 4                 | 11                 |

Therefore, our group decided to progress with idea#1--a gadget with a belt around the waist attached to a platform slightly above the butt which can spread the weight of the bag. We decided we did not want to just make another bag of new technology but instead a 'bag accessory', an excess gadget to help the bag to have less pressure applied on students' shoulders, or even what we hope is no pressure.

## 2.6 Comparing our product with other products in the market

Other products mainly targeting the problem we are focusing on include the Health Care AFT-B003 which costs USD 36.99 and the Verti Back Lumbar Support which costs USD 48.49 (Amazon). But our product is much more affordable than these products as our production resources and process are much more simpler. We hope to provide students an economical and useful solution to the problem. We have also identified other solutions such as sponges, skeletal-fitting cushions and even putting more straps at the bag's front. But we reconsider the facts of how these methods really release pressure and solve the problem of back arching.

# 3. Developing the idea

## 3.1 Our proposed invention

Our proposed invention is a base secured to a belt with both click strap and velcro strap. The base lifts the bag off the shoulders slightly which eases the shoulder of pressure slightly. In this manner, there is barely any pressure on your shoulders. Instead it is spread to the waist, butt and slight support from the shoulders for balance. The strap is also adjustable for people with waists of different widths. When the bag is carried, the base lifts the bag to reduce pressure. It is as if two hands were holding your bag up!

## 3.2 Purpose of our invention and its benefit to users

It is meant to eliminate muscle aches, musculoskeletal problems such as slanted spines etc. It can help students or anyone with heavy bags to have a more pressure-free trip. Apparently our product has solved any heavy bags related problems. Our targeted audience are mainly students and office-working adults. As the product is an original idea, people may not get used to having it strapped around the waist or so but it is definitely better than leaving all the weight to the shoulders. Through this invention, we hope to reduce the need for medical plasters for sore shoulders, back aches etc. Our main motive is to create less pressure for the shoulders, as mentioned in the name 'No Pressure'.

## 3.3 Problems we expect to encounter in constructing the invention

We expect to have problems over the dimensions and the scouting and deciding of our product. We wish to get the most affordable price in the market and the best quality. Prior to the dimensions, we expect to have different problems such as too tall, too short etc. It was all taken

into thorough considerations to come up with a most suitable dimension that is both easy and convenient. We also expect problems such as the weight and strength of the product. We hope for our product to be lightweight, strong, durable. But in search of this, our group member has taken a lot of effort before getting the type of material we wish to get. We also expect incidents like inventing failures which is unavoidable in a process of invention. Getting the parts together was the most difficult part and in overall, gathering products and inventing took over a span of two and half months.

### 3.4 Major milestones of our project work

Some milestones to mention is time management. As our group members are tied up with commitments, homework, even on weekends, we are tight. The need to take time to do our project work was a hassle but it was worthwhile. When everything had been done about 80%, it felt satisfying. Another major milestone is the clashes between group members. The group members could not make out a common time to meet up together. A lot of work was communicated virtually except for important moments such as rehearsal etc. Another milestone was the distribution of jobs. The group leader initiated to take up the toughest job--the prototype but others took up the report, slides etc. But each other felt we were not doing enough and some arguments kicked in. It was a crisis as work could not carry on but we soon resumed when both sides took a step back. In overall, I would say the invention process was pretty much smooth. We encountered less failure than expected and came out with a product soon enough.

## 4. The construction process

### 4.1 Structure of our product and materials chosen

The main structure of our product is mainly the base, the velcro strap and the click strap, the belt itself and a compartment for a raincoat, sealed with a zip. It has a base attached to the belt and the belt is tightened with both a belt strap and a velcro while the bag sits on the base, being lifted from the shoulders slightly. Simple but feasible. For the base, we used foam. But what type of foam? The type of foam for swimming boards, the durable, affordable and lightweight type. It was chosen as it is strong, lightweight and is affordable. It is the perfect choice for it to be the base after deep considerations. It is water-resistant and durable --the main reason. For the belt strap and click strap, we used the normal ones which could be bought anywhere. The zip for the small compartment for the raincoat was also the common type. The covering fabric is made with 100% polyester. The straps of our product is made of nylon and the raincoat is made of 100% peva which is water resistance.

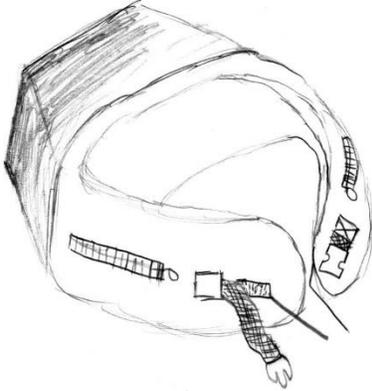
### 4.2 Consideration to construct the product

Considerations we had are things like having a durable material to work as the belt. The material had to be thick enough and had to be strong enough to be the "middleman" of spreading the weight. Another consideration we had was the difficulty of making the waist belt tight enough to work, especially for skinny people. Therefore, we actually not just put in the velcro but we actually still did a click strap with adjustable tightness. It allows anyone to wear it and put it around their waist. One more consideration we had is to prevent the bag from being drenched in a downpour when we have to travel over open ground as despite having an umbrella, it is unable

to cover the bag fully. We have inserted a compartment with a waterproof, raincoat-like material to cover the bag . Its sides are made with elastic strings which can be stretched to cover big bags to prevent rain from wetting the bags. The interior of the product is curved to custom to the shape of the butt as everyone's butt is impossible to be totally flat. The curved interior design is meant to accustom to a standard bottom of a person.

### 4.3 Documentation of our invention

#### Sketch



#### Prototype 1



Prototype 2



Final product



## 5. Modification and evaluation

From the first prototype, we used thin cardboard, then, we realised that the product was too bulky and there was a waste of materials if it was made as such. The second prototype was also made out of thin cardboard. Apart from making it shorter, we made the surface, which will be in contact with the back/hip, curved to better suit the user's body shape. Also, we made it more aesthetically-pleasing hence we made the faces slanted inwards. After we were happy with the look of things we used actual materials that we bought to make the final product.

## Citations

-Kriti, Saraswat. "The ill-effects of carrying heavy school bags". The Health Site. Dr. Zinel Unadkat, Dr Zubeil Patel and Dr Smarajit Chakrabarty, June 12, 2017.

-Amazon website

Division of Research, Department of Family & Community Medicine. Backpacks Carried By School Children. Retrieved August, 2018, from <http://researchers.sw.org/resources/docs/dorfam/dorfam-backpack-survey.pdf> (research)

Aofit-AFT. Health Care AFT-B003. Retrieved February, 2018, from <https://www.amazon.com/AFT-B003-Posture-Corrector-Adjustable-Shoulder/dp/B01A85M8WO> (similar product)

Verti Back. Verti Back Lumbar Support. Retrieved February, 2018, from <https://www.amazon.com/Verti-Back-Correcting-Adjustable-Physiotherapist/dp/B016VNT0CI> (similar product)