Hwa Chong Institution
Project Work
Category 3 Inventions Log Book

Title of Project: Bag Support Enhancement
Group Name: 3-46
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1. 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.

Firstly, when we were going to school and travelling back home, we realised that it was actually quite tiring for our shoulders when walking with a heavy bag after 10 minutes. We realised that many students experienced similar problems and were carrying bags too heavy for them, thus damaging their spine.

Secondly, after looking at news of plane crashes lately, we realised that we should have some safety protocols in case of an emergency plane crash, thus we wanted to invent a float so if the plane crashes in water, it is able to float on water so that nobody would lose their lives.

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

First of all, we realised that a bag support could be a lot of help to students because it could take much weight of their shoulders to lessen the pressure on their back.

Feasibility also played a role in choosing the problem. (we could not do something that was as big as an airplane. It was not within our reach)

We felt that the problem should be relevant to us because we believe that we would be able to understand the problem better.

1 C List some problems your group would like to solve. List also the considerations for selection of problem 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

*add more columns and rows where necessary

Considerations for Selection	Problems	
	Plane float	Bag support
Feasibility（1-5）	2	4
Impact（1-5）	5	4
Relevance（1-5）	3	5
Total Score	10	13

2. Define the Problem

(This is one…)

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)

A study scanned the backs of children aged 11-to-13 carrying backpacks that were approximately 20 to 30 percent of their body weight when the normal weight they carry should only be 10 percent! Not only did the children with heavier backpacks experience *disc compression*,which is a situation where excess weight on the spine causes it to compress,making children humpbacked .Researchers also noticed that some of them also had *lumbar asymmetry*.

A study referenced in *Science Daily*, found out that heavy loads could damage the soft tissues on the shoulder, which in turn might damage the nerves.

Disc compression--The compression of the spinal cord

Lumbar asymmetry -- The curvature of the spine

If you carry a heavy bag for too long, your shoulders roll forward and down. This causes the muscles in your neck to strain, leading to weak muscles and possibly lead to *thoracic outlet syndrome.*

Thoracic outlet syndrome--The compression of blood vessels or nerves in the thoracic outlet(the narrow space between your collarbone and first rib)

The main problem, in summary, is that by carrying heavy bags, students are actually hurting and damaging their backs. Do we want our children to have damaged backs in the future?

2 B Compare and contrast the existing or similar solutions.

Hip belt-- the hip belt is supposed to carry 80 percent of the bag's weight. However there really isn't much difference when using the hip belt or not.

A

Fig 2.21. The hip belt.

3.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.

3a Describe your proposed invention.

The support looks like an L-shape from the side view to allow the bag to rest and lean on it. It has chest straps and waist straps to tighten the support around the body. (This is not how the confirmed invention looks like, we have changed it. This is only for proposal)

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

It relieves the load of the bag so that students do not carry such a heavy bag. Hence there is a lower risk of their backs getting injured.

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

The existing solution is the straps that are commonly seen in bags, the hip and chest(sternum) belt. Scientifically, wearing just one of the two at any time does not have much, if not any effect in lifting the weight. With our product, it could be used as both an addition and also can be used on its own. Since the product is an attachment, it can be used as an addition to the belts already on the bag, which help to lighten it even more, or if your bag does not have the belts, it can be used on its own and still be effective.

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

I expect that it would not work the first few times we make the prototype.

I expect that it will be hard to look for materials.

I expect that it might exceed our budget of 20 dollars.

We will not be able to meet with Teacher Mentor during the June holidays as she is overseas(hence we will update her via whatsapp)

3e What and when are the major milestone (project timeline) in your invention?

April 2: Proposal Evaluation

By June Hols: Get final idea and drawings done

June 20: Start and finish building the first(hopefully final) prototype

June 27: Start and finish Final prototype

Throughout June Hols: Work on Mid-Term evaluation slides and logbook

4. Construction <u>or</u> 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.

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

~~Plastic was used for the base as it is strong, lightweight and cheap(0.50-1.50 dollars per kg!)~~

There has been an update. We will be using the parts from a baby carrier because it is more comfortable to the hip:)

We used bag straps so that the wearer would be comfortable. However this time we are recycling old bag straps. At this point of time(28 June), we will not be using a hip belt.

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

It must lighten the load of the bag and reduce the workload on the shoulders.

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

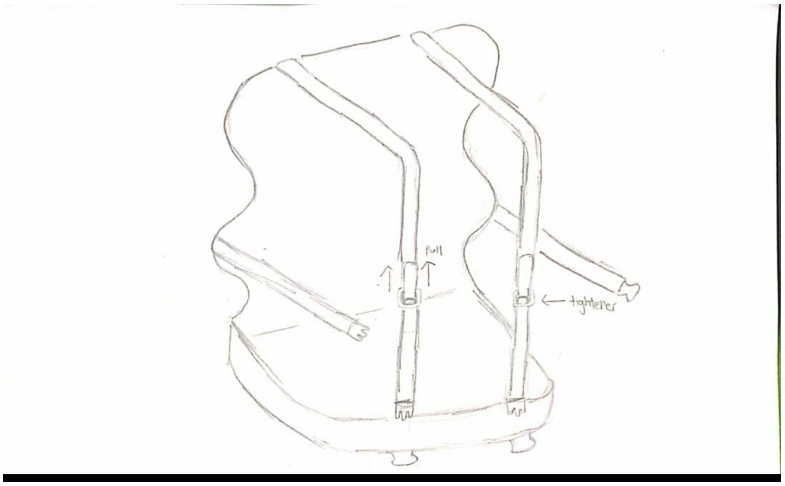

Fig 4.31. A drawing of the prototype. This drawing will be transferred onto isometric paper.

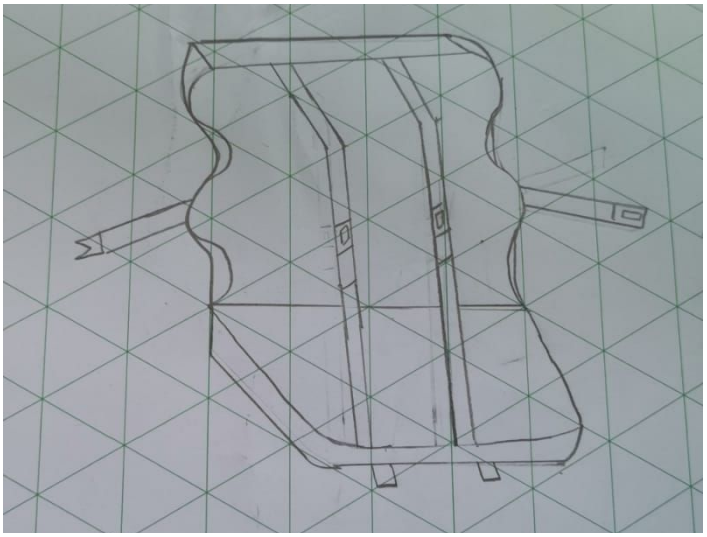

Fig. 4.32. Drawing on isometric paper.

Cloth was sewn onto the computer bag at the makerspace on 20 June. However because some of the materials were too thick to be sewn by the sewing machine, we could not sew them at the makerspace.

Fig. 4.33. The computer bag with cloth sewn onto it.

We sewn the straps and laptop bag onto the baby carrier and completed our product

5.Modification and Evaluation

(Oops...)

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.

5a 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: 20 June 2019	Pass	Fail	Potential Failure	
Test Criteria 1 **It must be able to lighten the load of our shoulders**	✓			It does lift the bag up but it does not lift the bag as much as we imagined. However we would be adding a hip belt to the support after the evaluation to further lift the bag.
Test Criteria 2 **It must be able to support the bag without breaking**	✓			It did not break when we placed the bag on the invention and carried it.
Test Criteria 3 (scroll down)	✓			The materials are free!

The cost must not exceed 20 dollars				

*Add more rows for more criteria
** Repeat table for next test iteration

6.References

(Thanks...)

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

6a 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.)

Manning-Schaffel, V. (2019). Is your bag wrecking your back?. Retrieved from https://www.nbcnews.com/better/health/why-bags-are-wrecking-our-backs-ncna803541

Carrying Heavy Bags: Shoulder and Back Injuries | Campbell Clinic Orthopaedics. (2019). Retrieved from https://www.campbellclinic.com/2018/11/21/carrying-heavy-bags-shoulder-and-back-injuries/

How to Choose the Best Backpack | Backpacking Packs | EMS. (2019). Retrieved from https://www.ems.com/f/ea-how-to-choose-a-backpack.html

[Image]. Retrieved from https://blog.tortugabackpacks.com/wp-content/uploads/2018/04/hip-belts-header.jpg

(2014, September 18). What can the Prices of Plastics Teach Us? Retrieved June 5, 2019, from https://www.plasticsouptrip.com/post/97791290765/what-can-the-prices-of-plastics-teach-us