

Category 3 Written Report

Title of Project: EZ-Scrub

Group Name: 03-20

Group Members: Loh Guan Yang, Aston Long and Lin Yu Kang

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Problem Finding

In order to determine what problem to work on to create our prototype, we decided to come up with a broad list of problems first, before making an informed choice, for example using the Decision-Making Matrix to find the most prevalent problem in society that we could work on for our project. By searching up interesting topics and problems around the world, eg. problems with those who require walking sticks to assist with mobility every day and those suffering from arthritis, we could identify the issues faced by the people nowadays that we could potentially create solutions for, thus helping with our brainstorming process. The 20 problems we came up with are in Appendix A.

In order to select the problem that we would work on, we came up with a list of criteria that we could use to effectively determine the problem that we would work on. From such a large list of problems, of course we first had to narrow them down to the most important before we could make an effective selection. Therefore, we streamlined our list to 3 problems that were not too broad or too narrow/had too little impact. Then, we considered

- Our product's impact to society;
- Whether it was it within our abilities to create something to solve this issue;
- and the cost-effectiveness of our product.

We wanted to make a product that would be helpful and give back to society and help the needy. At the same time, we needed to make sure that we had enough resources and it was within our ability to create the product we wanted to create. We also wanted to make our product accessible to everyone, so that even the less-fortunate could afford our product.

The three problems we narrowed our list down to were the vitamin deficiencies suffered by the elderly, difficulties arthritis patients face when doing daily activities, and the difficulties Parkinson's patients face even when carrying out simple tasks. From our Decision-Making Matrix, the difficulty Parkinson's Disease patients faced while carrying out simple tasks scored consistently well on the impact on society, practicality and potential affordability, thus we concluded that it was the most prevalent problem in society that we could invent a solution for.

Considerations for Selection	Problems		
	#1 The elderly suffer vitamin deficiencies as they have difficulty finding food that is soft enough and rich in vitamins	#2 Elderly people with arthritis find it difficult to complete strenuous or even mild exercises to keep healthy because of joint pains	#3 People with Parkinson's disease find it difficult to carry out simple tasks
Impact on Society	1	5	5
Practicality	5	1	3
Potential Cost of product	5	3	4
Total Score	11	9	12

Defining the Problem

To define the problem, we conducted extensive research on the extent of Parkinson's disease. Parkinson's disease is the second most common neurodegenerative disease in Singapore with a prevalence of three in every 1,000 patients above the age 50. As of 2015, 6 000 to 8 000 people suffer from this disease. Furthermore, over the years, as Singapore's population continues to age, the number of people with Parkinson's Disease increases. Out of this massive number of people, there is definitely a large percentage of them who are home-bound or living alone, and thus experience substantial difficulty washing plates by themselves due to their frequent hand tremors that result in them dropping the plates or not being able to grasp the plates properly to wash plates effectively.

Problem Statement:

How might we make it easier and more convenient for those with Parkinson's Disease to wash plates by themselves?

Some existing solutions that we have found are dishwashers, dishwashing gloves and the EasyGoDishwasher. The pros of dishwashers are that they are convenient, easy to operate and clean dishes effectively. The cons of dishwashers are that they are not commonly used in Singapore, bulky, tend to break down easily, expensive, inconvenient to maintain and are easy for bacteria and mould to manifest. It is also difficult to clean small spaces between utensils. The pros of dishwashing gloves are that they have grooves that will increase the friction between the hand and the dish and protect the hand from detergent. The cons of dishwashing gloves are that they will trap food particles and grime, easily causing a bacterial manifestation. Furthermore, they are one-size fits all, making it difficult to find one that is durable and fits well. Finally, they may be difficult to put on due to hand tremors and weakness in the hand. The pros of the EasyGoDishwasher are that it cleans better than hand wash and is portable. The cons of the EasyGoDishwasher are that it is made of unreliable plastic that causes the parts to snap, are generally disliked by buyers, and can only clean very flat plates, cannot clean rice bowls.

Our BIG IDEA

Our design is simple yet versatile. As compared to the existing solution which is the dishwasher, the EZ-Scrub is more compact and is able to clean between small spaces with the presence of the bristles. As there are holes on the board, any waste water generated from the wash can be drained efficiently, making the washing of dishes more hygienic. Finally, the board is durable, as well as easy to maintain and wash. We can see this in the fact that the board has a simple design. After every use, the board can be washed easily with a rinse of water and some soap.

Through this project, we aim to counter the effects of Parkinsons' hand tremors and help Parkinsons' patients wash their dishes with more ease Furthermore, we would like our product to be cost effective, convenient, durable and effective at solving the problem.

Our proposed invention will be more compact and simple than existing solutions, yet versatile. Our invention can clean better than existing solutions as the bristles can clean between the small spaces in utensils. Our invention also has more effective drainage as it is

designed with many holes for that. Finally, our invention is easier to maintain and wash than other inventions.

In the course of our prototyping, we foresaw some problems with our prototype so as to be better prepared to combat such issues. These were that the:

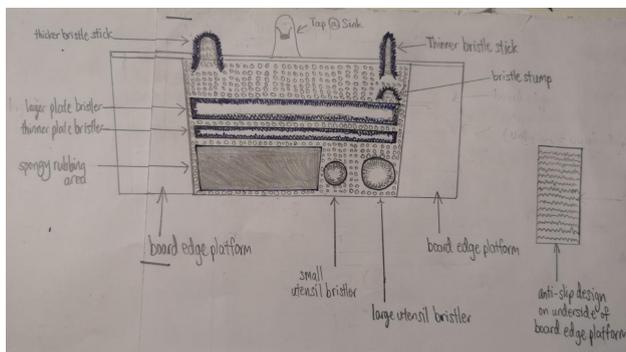
- Product could fall apart completely when we were trying to fix parts together, forcing us to do everything again
- Product could possibly not work the way it is supposed to work eg. not as effective

Project Timeline

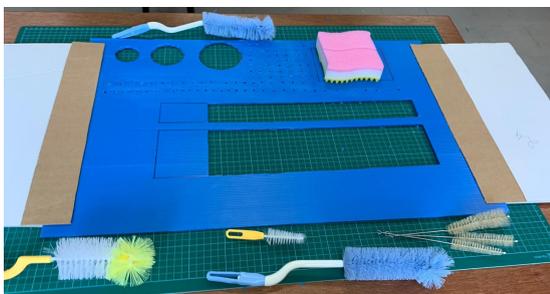
After brainstorming ideas and possible solutions to them, we decided on a problem to work on on February 27. After that, we made our way down regularly to Makerspace on Tuesdays and Thursdays to work on our first prototype. On March 19, we finished our first prototype and sought the opinions of expert mentors at the IvP Draft Session 1. After the draft session, we started working on our second prototype, using advice we gathered from various consultations with mentors and expert mentors at events like the IvP Seminar and Draft Sessions. By the end of the June Holidays, we finished our second prototype and at the mid-term evaluations, we realized there were multiple flaws. Finally, on 30 July, we created our last prototype with some changes.

Construction Process

In order to have a better idea of what to build for our prototype, we first made a sketch of what we wanted to create.



However, our first prototype did not work out too well as it was too bulky and could not even fit through a regular door.



Thus, for our 2nd prototype (*Appendix D*), we decided to make it more compact through the idea of making it a 3D object instead of a flat plane which takes up significantly more space lengthwise.



Therefore, we bought affordable brushes from a provision shop and found the other materials we needed from Makerspace, namely six 5mm cast acrylic sheets and one 3mm cast acrylic sheet. In order to build the prototype itself, we made our way to the Science Research Centre Physics Lab to use the scroll saws, hole drills, files and chloroform to cut out necessary pieces of the plastic and assemble our prototype with the supervision of the teachers there.

When selecting these materials, we had multiple considerations. These were their cost-effectiveness, suitability and usefulness, and whether we had enough resources and technology to create our envisioned prototype.

Modification and Evaluation

How our prototype works:

<https://drive.google.com/file/d/1FSLZdggH978PCobHIsvSflaNoR0QR4w-/view?usp=sharing>

In order to confirm if our prototype could work, we conducted multiple tests on it. Our prototype did not fare well in this test. We tested it based on 4 aspects: Strength, Durability, Convenience and Effectiveness.

Test Iteration: 1st	Tick			Remarks
Test Date: 29 June 2019	Pass	Fail	Potential Failure	
Strength	X			Is able to sustain its weight, and resist multiple hits from us.
Durability			X	Brushes unable to stick on well.
Convenience			X	Not that easy to clean our product.

Effectiveness			X	Not that easy to clean dishes.
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Thus, we made modifications to our prototype, ensuring that it would cover these areas better. Instead of using an adhesive, we decided to use metal ties to affix the brushes, allowing them to firmly grip on. Then, we re-positioned the brushes, making them tightly packed together, so they would be close enough so they could scrape off any particles or grime, but at the same time allow the dish to pass through with ease. These are the results of our second test.

Test Iteration: 2nd	Tick			Remarks
Test Date: 19 July 2019	Pass	Fail	Potential Failure	
Strength	X			Still matches previous results.
Durability	X			Brushes much tighter now.
Convenience			(X)	Not that easy to clean our product.
Effectiveness	X		(X)	Easier to clean dishes, even with shaky hands.

References

These are the references we used to gather information for our prototype, cited in APA format.

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Appendixes

Appendix A - List of Problems

1. Stair lifts are expensive to install and maintain.
2. Hearing aids are very expensive, especially for people like the elderly.
3. Elderly people with arthritis find it difficult to complete strenuous or even mild exercises to keep healthy because of joint pains.
4. Blind people have to ring bells in public places to alert surrounding people that they are coming through. Sometimes, people often mistake the bell toll for something else and don't notice that the blind person is walking in front of them. This leads to them walking in the path of the blind person, increasing the risk of accidents and falls happening. The bell also interferes with one of the blind person's most important senses, hearing.
5. Elderly people with arthritis may find it difficult to perform complex tasks requiring joint movements e.g. cooking.
6. Elderly may also not look after themselves well and suffer nutritional deficiencies.
7. Deaf people cannot hear announcements made in public places and events especially urgent ones. For example, they cannot hear announcements made in the Mass Rapid Transport stations.
8. The hard of hearing cannot communicate with each other easily in the dark.
9. Blind people may have their safety compromised in public places with lots of steps or uneven flooring, and may trip and fall.
10. People with mental health conditions may be found difficult to approach by others and thus ostracised.
11. People with autism may be avoided because of active stigma
12. Hearing aids require a lot of maintenance and are thus very inconvenient for the hard of hearing eg. Importance to have spare batteries while commuting and keeping them out of water at all times, posing problems during rain and making it impossible for people to swim.
13. Even though solar panels help to decrease the amount of emissions given out, it is expensive and traditional fossil fuels like coal are cheaper alternatives that companies like to use. However, solar panels are environmentally-friendly while coal is a non-renewable resource and not only will eventually run out, but also produces a lot of carbon emissions that contributes to global warming. This results in an undesired chain effect and the world will warm more quickly.
14. The blind cannot board buses easily as bus captains do not announce the bus number when arriving at the bus station, leaving the blind with no audio clues on what bus it is, so they may get confused and board the wrong bus.
15. When fish in aquariums are fed, owners may accidentally feed too much food and they drift to the bottom or get trapped in sand and decompose without being noticed by the fish, which calls to every fish-keeper to clean the tank, which is stressful for both owner and fish.
16. Cars, taxis and buses give out a lot of carbon emissions. Year by year, the number of such vehicles being used on the streets everyday is increasing. This results in a vicious cycle in that the amount of harmful gases that contribute massively to global warming increase year by year.
17. People hardly move to the back of the bus nowadays due to the lack of effort made by them.

18. Modern technological devices are not conducive to the elderly as they do not know how to use them. Eg. Changi Airport Terminal (4 FAST check in)
19. We rely too much on cleaners nowadays, and many people often leave their trays on the table for the cleaners to collect. Not only does this increase the workload of the cleaner, it also acts as an inconvenience to someone who has settled at the seat but has no space to place down their food.
20. Parkinson's patients find it difficult or almost impossible to handwrite notes or letters, and also have extreme difficulty with tying shoelaces. In general, the tremors in Parkinson's patients' hands make everything they have to do with their hands significantly more difficult but these are some common problems.