How can design improve swimming through ergonomics and economics?

Word Count: 4041 - 46 = 3995
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Criteria A: Analysis
Introduction and Research Question

Living in an archipelago made up of over 7,000 islands, it is evident that swimming is a common activity that most people learn here in the Philippines. Most of these people do not have access to swimming aids to help learn or improve their swimming skills or stroke. The focus of my extended essay is to consider the redesign of hand/finger paddles into a more efficient and ergonomic swim aid (Images: Finis Finger Paddles1 and Fins2).

Additionally, there are local swim teams in the Philippines who learn to swim competitively without the use of such swimming aids as it is unavailable due to their geographical location and or the price range. Using larger paddles through creating their own version of a swimming paddle can “badly affect the stroke of the swimmer and possibly injure them if not designed or made properly” (Lozada). Being a swimmer myself, I have had extensive experience in using swimming aids and I am a long term patient at a physical therapy center due to the overuse of my shoulder muscles during swimming. This is known as “Swimmer’s Shoulder”.

Since my freshman year of high school, I have been swimming nine times a week for training. At that time, a lot of stress was put on my shoulders and while using paddles, especially larger ones, which contributed to the injury. Having the problem of swimmers in the Philippines not being able to afford swimming aid, and the issue on shoulder injury due to the overuse of shoulder muscles. Through my constructive discontent, I propose to follow the design cycle to analyse the design opportunity, conceptualise a design, develop the design, create it and finally evaluate it.

The secondary research collected for the design of finger paddles are mainly from swim websites such as SwimOutlet4 and Speedo5 and these help justify why finger paddles are advantageous for swimmers. For primary research, an interview with Anthony Lozada, a renowned national swimming coach of the Philippines, was conducted to further the design of finger paddles for the swimming community, and part of my research will consider an economical material that would allow the manufacture to be achieved at a lower cost.

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1 https://www.swimoutlet.com/p/finis-agility-paddle-41333/
2 https://www.swimoutlet.com/p/finis-zoomers-gold-swim-fins-12877?q=1&richrelevance&ClickCP&item_page1
3 http://physioworks.com/au/jaures-conditions-1/swimmers-shoulder
4 https://www.swimoutlet.com/guides/how-to-prevent-shoulder-injuries-from-swimming
5 http://www.speedo.com/on/demandware.store/Sites-spdeueur-Site/en_JE/GeoShow-Content?cid=9517be9b-e432-40e8-8f77-e35889265bc3
**Analysis of Competing Products**

<table>
<thead>
<tr>
<th>Target Market: Athlete swimmers ages 12-40</th>
<th>MadWave Finger Paddles ⁸</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Market Analysis:</strong> Minimalist design that appeals to beginning swimmers as it offers two straps making it easier to keep the paddle on for the swimmer.</td>
<td></td>
</tr>
<tr>
<td><strong>Aesthetic Req.:</strong> Sleek paddle, colored black with a color green to indicate straps and logo.</td>
<td></td>
</tr>
<tr>
<td><strong>Cost Constraints:</strong> 377.51 php</td>
<td></td>
</tr>
<tr>
<td><strong>Customer Req.:</strong> Swimming aid to build upper body strength: reducing stress on the shoulder and used to correct stroke technique.</td>
<td>Image removed for copyright reasons</td>
</tr>
<tr>
<td><strong>Environmental Req.:</strong> PP is available to be reused and recycled.</td>
<td></td>
</tr>
<tr>
<td><strong>Size Constraints:</strong> 110 x 80 x 4mm</td>
<td></td>
</tr>
<tr>
<td><strong>Safety:</strong> No sharp corners, minimal danger element.</td>
<td></td>
</tr>
<tr>
<td><strong>Materials:</strong> Polypropylene &amp; Silicone</td>
<td></td>
</tr>
<tr>
<td><strong>Manufacturing:</strong> Injection molded body</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Target Market: Athlete swimmers ages 12-40</th>
<th>Speedo Biofuse Finger Paddle ⁹</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Market Analysis:</strong> Simple aesthetic to attract a wide audience and has two straps with a rubbery surface to aid beginners.</td>
<td></td>
</tr>
<tr>
<td><strong>Aesthetic Req.:</strong> Triangular shape to help with the hand entry in the water, and color scheme easily indicates each material.</td>
<td></td>
</tr>
<tr>
<td><strong>Cost Constraints:</strong> 1511.10 php</td>
<td></td>
</tr>
<tr>
<td><strong>Customer Req.:</strong> Strengthens upper body strength, and was &quot;ergonomically engineered&quot;(Speedo) to improve grip and reduce hand fatigue.</td>
<td>Image removed for copyright reasons</td>
</tr>
<tr>
<td><strong>Environmental Req.:</strong> Polypropylene can be reused and recycled</td>
<td></td>
</tr>
<tr>
<td><strong>Size Constraints:</strong> 100mm in length</td>
<td></td>
</tr>
<tr>
<td><strong>Safety:</strong> No sharp corners, minimal danger element.</td>
<td></td>
</tr>
<tr>
<td><strong>Materials:</strong> Polypropylene and hard plastic</td>
<td></td>
</tr>
<tr>
<td><strong>Manufacturing:</strong> Injection molding</td>
<td></td>
</tr>
</tbody>
</table>

Target Market: Athlete swimmers ages 12-40
Market Analysis: Strapless paddles mean less support for the swimmer, challenging them to keep the paddle on hand for technique purposes, popular for advanced swimmers.
Aesthetic Req.: Black with the logo in yellow, showing a minimalistic design catering the aesthetic requirements for the majority.
Cost Constraints: 551 php
Customer Req.: “The strapless design of the paddles increase the swimmer’s stroke awareness and emphasize stroke errors, making it easier to identify and correct your technique.” (Finis)
Environmental Req.: PP can be reused and recycled.
Size Constraints: 120mm in length
Safety: No sharp corners, minimal danger element.
Materials: Polypropylene
Manufacturing: Injection molding.

The main weakness of all the products and designs above is that they do not come at an affordable price, and the structure of the paddles are the same in construct as they all cover just the tips of the finger when being used.

Ergonomics:

These measurements will help find a suitable size of the paddle for the majority of users to ensure the prototype can be tested by a large group of users.

<table>
<thead>
<tr>
<th>Subject</th>
<th>A.</th>
<th>B.</th>
<th>C.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Raya</td>
<td>101</td>
<td>86</td>
<td>18</td>
</tr>
<tr>
<td>Ines</td>
<td>99</td>
<td>80</td>
<td>19</td>
</tr>
<tr>
<td>Alfonso</td>
<td>97</td>
<td>87</td>
<td>15</td>
</tr>
</tbody>
</table>

Measurements in millimeters (mm)

https://www.proswimwear.co.uk/finis-instinct-sculling-paddles.html
Material Requirements:
I considered a variety of plastics but focused on locally available materials.

Acrylic Plastic\(^9\)
Transparent thermoplastic: comes in thick sheets of plastic and is light in weight. It carries a good light weight resource for a product like a finger paddle, and is readily available from a number of sources in Manila.
(COST) 150mm x 150mm x 3mm= 150php

Reused Goggle Straps\(^{10}\) (Rubber based Polymer)
Upcycling old goggle straps are economical and environmentally sustainable, and will reduce the costs of production as they will be sourced by given donations.

Manufacturing Requirements:

Laser Cutting\(^{11}\)
The machine (GCC 60W Bedsize) will be most useful in making the finger paddles as it is an efficient way to properly cut the paddles to the right size and shape. This will also reduce manufacturing time.

Advantages of the Finger Paddle: Interview with Anthony Lozada\(^{12}\)

For an expert appraisal I interviewed a national swim coach, recognized nationwide as one of the top coaches in the country for bringing swimmers to the SEA games and Olympics. In summary, he stated that the swimmer's shoulder "is when the swimmer experiences pain when doing the underwater stroke as pressure is applied to the shoulder" (Lozada). In order to treat this problem, strengthening the shoulder must be done without permanently injuring the joint. Additionally, using finger paddles is very beneficial to a swimmer when acting as a

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\(^{10}\) http://www.triboutique.ca/TYR-Universal-Swim-Goggle-Replacement-Headstrap-p/yr-lgcs-001.htm
\(^{11}\) https://dir.indiamart.com/mpcat/laser-cutting-machines.html
\(^{12}\) http://www.racedaymag.com/triathlon-coaches-of-the-philippines-schedules-locations-contact-info/anthony-lozada-for-raceday-magazine/
swimming aid as it lessens the chance of swimmer’s shoulder, or the chance of worsening the condition. This is because the surface area of the finger paddle is less than an actual paddle, thus putting less tension on the shoulder and area of injury. Also, the finger paddle is a swimming aid that helps slowly strengthen the shoulder with its added surface area. From the results and answers of the interview, it is evident that a certified national coach has approved the use of finger paddles for swimmers, making this design development a viable project.

To further support this design direction, well known swimming websites that give tips and sell swimming aids, such as Swim Outlet13 and Speedo14, have also stated that finger paddles help provide the swimmer “a greater awareness of the feel of the water through each stroke - ideal for improving your arm position and technique” (Speedo). Swim outlet has also stated that avoiding hand paddles would also help lessen the risk of worsening shoulder injuries, but as Coach Lozada said, he believes that strengthening the upper body, back and shoulder will help stop the shoulder injury from reoccurring. On Speedo’s website, it mentioned that finger paddles are a great type of swimming aid as it gives good strength training to the swimmer by providing “a more challenging workout, particularly for the upper body” (Speedo). By building the swimmer’s upper body strength with small approaches, such as using finger paddles over hand paddles, the swimmer will be able to slowly recover and better their stroke technique.

**Design Brief**

I am going to **design and make an economical/environmental version of a finger paddle**. Finger paddles put less pressure on the shoulder of the swimmer than regular paddles. Swimmer’s shoulder is a very common injury for these athletes as it is mainly caused from overworking the shoulder without stretching or from possible pressure applied to the shoulder. The finger paddles that I will be making will be smaller in a way that it still accommodates the need as a swimming aid, but will help by not putting the same amount of pressure a bigger paddle would. To make this paddle more economical, the main material of this paddle will be a 3mm thick acrylic plastic which is thicker than a regular paddle, but can still provide the durability and function of a regular paddle at a lower price. Additionally, old goggle straps will be recycled in order to add to the paddles environmental aspect.

**Constraints:** Acrylic offers physical/mechanical properties to offer durability and strength whilst the range of colors offer aesthetic properties to the paddle.

**Feasibility:** My product is feasible as its costs is minimal, estimated sales price around 200-300 php which is 25% below the cheapest existing market price. Also, manufacturing time will be shortened.

14 http://www.speedo.com/on/demandware.store/Sites-spdeuer-Site/en_IE/GeoShow-Content?cid=9617be9b-e432-40e8-8f77-e35589265bcd
Target Market/Audience: My product is aimed at a low socioeconomic swimming community. From my personal swimming experience, the market in Manila includes children from 8 up to adults of 55 years old equally represented as male/female. As for the needs of the market and audience, the finger paddles would have to be cheap, easy to use, practical and a functional aid for swimming. Whereas the wants would focus on the aesthetic properties such as color and shape.

Design Specifications

Aesthetic Requirements
Using bright and colorful designs will help the paddles aesthetically become pleasing to a greater number of target audience. Testing can be done through surveying the target audience of their opinions for colour, or shape of the prototype.

Size and Cost Constraints
The size of my product will be no more than 120mm x 90mm x 3mm, and the finger paddles should be no more than 300 php, depending on the fixed and variable costs of the resources used. Testing can be done through re-measuring the prototype in the end, with photographic evidence, and sending a survey on how much the target market is willing to spend on the paddle itself.

Customer Constraints
These finger paddles should be comfortable, easy to use and inexpensive to meet the design goal. Testing will involve a User Trial and interview with users to determine efficiency.

Environmental Constraints
Acrylic plastic is the main material can be easily recycled. Additionally, the straps used will be upcycled goggle straps, creating a new life for the goggle strap. This will be tested by verifying choice of materials through user trials and surveys of the target audience.

Safety Considerations
My product has to be safe for different customers and users, so I will have to make sure that there are smooth surfaces and no sharp edges on the prototype. I will test this by having a user trial.

Performance Requirements and Constraints
The function of the finger paddle is to make it more economical and to be a swimming aid that puts less stress on the shoulder whilst correcting technique. Testing will be done through the finger paddles being used by national swimmers, and surveying them on its function and performance with photographic evidence.
**Materials Requirements**

I will use acrylic plastic and rubber based polymer as the materials for the finger paddles, helping lessen the price with the minimal amount of materials used. A survey will be sent to an audience to evaluate the materials used in the prototype.

**Manufacturing Requirements**

Using the laser cutter will create the finger paddles by cutting and engraving the designs. A gantt chart will be used to show the manufacturing process of the first prototype.

**Marketing Specifications**

**Target Market/Audience**

The finger paddles will be targeted to people ages 8-55 who take swimming as a sport as they are to be the biggest buyers of this product. Since the swimming community will be the market of this product, it would have to be mainly focused towards the competitive side of the sport, or for just technique correction.

Being more specific on the market, the target audience will be swimmers who train more than once a week and need the use of swimming aid for training purposes. This can range from children who need the swim aid for stroke correction to swimmers who are advanced at swimming but use swimming aid for training. Lastly, the most important target audience for these finger paddles would be people who cannot afford to buy swimming aid from popular brands such as Arena and Speedo as they are too expensive. These upcycled paddles will be able to give the swimming aid needed at a lower price.

**User Need**

This product would only have one purpose, which is to provide a more economical swimming aid through the use of acrylic plastic and old goggle straps. This can attract people as it gives swimming aid a cheaper and more eco friendly alternative, convincing the target audience to purchase it.

**Market Analysis**

The overall cost of the finger paddles will be determined at the end of the production stage, so that the cumulative prices of all the resources and manufacturing that will be put into making the finger paddles can be added then. But for now, I feel that the resources used for this will be inexpensive as stated in the cost requirements.
## Criteria B: Application of Knowledge in Construction

### Design Ideas

<table>
<thead>
<tr>
<th>Conceptual T</th>
<th>Design Technology: Example B</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Target Market:</strong> Swimmers ages 8-55</td>
<td><strong>Market Analysis:</strong> Swimmers that train regularly that need from improvement</td>
</tr>
<tr>
<td><strong>Aesthetic Req.:</strong> Simple and practical</td>
<td><strong>Cost Constraints:</strong> 130 php</td>
</tr>
<tr>
<td><strong>Customer Req.:</strong> Must be a practical swimming aid to correct form and lessen shoulder tension</td>
<td><strong>Environmental Req.:</strong> Uses only acrylic and old goggle straps</td>
</tr>
<tr>
<td><strong>Safety:</strong> Flat surface with curved edges</td>
<td><strong>Materials:</strong> Acrylic plastic, goggle straps</td>
</tr>
<tr>
<td><strong>Manufacturing:</strong> Laser cutting</td>
<td><strong>Size:</strong> 85 x 70 x 2 mm</td>
</tr>
<tr>
<td>- Simple structure to provide a minimalist feel to it, resembling other basic paddles</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Conceptual T</th>
<th>Design Technology: Example B</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Target Market:</strong> Elite swimmers ages 13-35</td>
<td><strong>Market Analysis:</strong> Swimmers that train regularly with upper body strengthening and form correction</td>
</tr>
<tr>
<td><strong>Aesthetic Req.:</strong> Simple and practical</td>
<td><strong>Cost Constraints:</strong> 130 php</td>
</tr>
<tr>
<td><strong>Customer Req.:</strong> Must be a practical swimming aid to correct form and lessen shoulder tension</td>
<td><strong>Environmental Req.:</strong> Uses only acrylic and old goggle straps</td>
</tr>
<tr>
<td><strong>Safety:</strong> Flat surface with curved edges</td>
<td><strong>Materials:</strong> Acrylic plastic, goggle straps</td>
</tr>
<tr>
<td><strong>Manufacturing:</strong> Laser cutting</td>
<td><strong>Size:</strong> 95 x 80 x 2 mm</td>
</tr>
<tr>
<td>- Structure helps the water entry of the swimmer to be more precise (gives the swimmer more hold of the water with a smaller surface area)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Conceptual T</th>
<th>Design Technology: Example B</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Target Market:</strong> Elite swimmers ages 13-35</td>
<td><strong>Market Analysis:</strong> Swimmers that train regularly with upper body strengthening for the butterfly and breaststroke</td>
</tr>
<tr>
<td><strong>Aesthetic Req.:</strong> Pleasing to butterflyers breaststrokers with unique shape</td>
<td><strong>Cost Constraints:</strong> 110 php</td>
</tr>
<tr>
<td><strong>Customer Req.:</strong> Help the outsweep entry of the butterfly and breaststroke</td>
<td><strong>Environmental Req.:</strong> Uses only acrylic and old goggle straps</td>
</tr>
<tr>
<td><strong>Safety:</strong> Flat surface with curved edges</td>
<td><strong>Materials:</strong> Acrylic plastic, goggle straps</td>
</tr>
<tr>
<td><strong>Manufacturing:</strong> Laser cutting, line bending</td>
<td><strong>Size:</strong> 100 x 70 x 2 mm</td>
</tr>
<tr>
<td>- Targeted towards butterflyers and breaststrokers: curved outer edge helps the outsweep of the swimmer</td>
<td></td>
</tr>
</tbody>
</table>
Design Development

This design is composed of features from the design ideas, and uses the line bender and laser cutter to create a slip in the paddle to act as the finger hold, helping form correction. This is evident because if the paddle falls off, then it shows that there is an error in the stroke. With this design, swimmers will be able to correct their technique with less tension on their shoulders whilst buying it at a price of 110 php due to the lack of straps.

A change was made to the design as the interview conducted with Anthony Lozada showed that the most innovative approach to creating a useful swimming aid would be to make the finger paddles longer to fit just the four fingers without the thumb. This ensures that the swimmer can easily build their upper strength with less hold of the water and lessen the shoulder injury. This is why this design would be most practical to manufacture due to the simplicity in its design as it meets the costs and performance constraints well, and will be closely looked at in the Final Design.
Final Design

Whole paddle only fits bottom to top of the four fingers, excluding the thumb

2mm in thickness

Added holes for adjustable straps

Name: “Philblade”
Target Market: Training swimmers ages 8-55
Market Analysis: Swimmers that train regularly with upper body strengthening
Aesthetic Req.: Simple and practical to beginners and elites
Cost Constraints: 100 php
Customer Requirements: Helps give more hold to the fingers and lessen shoulder tension
Environmental Requirements: Uses only acrylic and old goggle straps
Safety: Flat surface with curved edges
Materials: Acrylic plastic, goggle straps
Manufacturing: Laser cutting
Size: 85 x 95 x 3 mm

- Accordingly to Lozada, this will help with less shoulder tension and give a greater hold of the water which will help arm placement and water entry with its curved tip.

2D Design

The image on the left shows the 2D Techsoft design created on the computer to act as the blueprints for the laser cutter. This will show the machine the external and internal cuts of the paddle, and the engravings to indicate the left and right side.
Criteria C: Development of a Detailed Design
Materials and components for a prototype

Laser Cut and Engraved Acrylic Plastic Sheet
The final design of the “Philblade” will be made out of an acrylic plastic sheet. This is because it is a durable and water resistant material, and only deforms when a high amount of heat is placed on it. Since the finger paddles won’t be exposed to a high heated environment, it will be able to have a longer shelf life. The acrylic plastic sheet can come in a variety of colors and opacities so that it can cater to make a variety of designs for the user. Lastly, acrylic will be easy to work with as it is light in weight, which is perfect for swimming aid.

Upcycled Goggle Straps
Using the material of reused goggle straps will give the prototype a more environmental approach and also lessens the overall cost of the finger paddle. By minimizing this cost, the more economical the finger paddle will become, catering it to a larger audience in the swimming community. People often throw away
overused goggles but the straps are still ready for use, which is what brought me to give these straps another purpose.

**Manufacturing techniques for prototype production**

Laser cutting and engraving the acrylic plastic

The laser cutting machine will be used to cut out the finger paddles from the acrylic sheet in its desired shape and size. In able to do this, I will use a computer aided software called “Techsoft 2-D Design,” to draw out the paddle to its exact shape and size, and engrave the L and R to indicate which paddle is for which hand. Using the computer software and laser cutting machine has allowed me more experience with using the software, and also the opportunity to upgrade the design in the future.

**Gantt Chart**

<table>
<thead>
<tr>
<th>Task and Date</th>
<th>June 3</th>
<th>June 4</th>
<th>June 5</th>
<th>June 6</th>
<th>June 7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consultation with Coach Lozada</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Draw CAD on TechSoft 2D</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Finalize CAD Drawing</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Open TechSoft and Upload CAD file onto Laser Cutting Machine</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Laser Cut Paddle Design</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>File Edges of Cut Paddle</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Attach Straps onto Final Design</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Test Trial</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adjust measurements on CAD</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Laser Cut Paddle Design</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>File Edges of Cut Paddle</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Attach Straps and Final Trial</td>
<td></td>
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</tbody>
</table>
Laser Cut Model

At the end of the manufacturing stage, the “Philblade” paddles were created using the laser cutter and the 2D techsoft program to design the wanted structure. After assembling it with the goggle straps, the finger paddles were able to look exactly as its desired look, and the sizing of the “Philblade” was the right size as the sizes matched the final drawing specification.
Criteria D: Testing and Evaluation

Test trial and Improvements

Two subjects were chosen to test the finger paddles and had very positive reviews on using the swimming aid. Additionally, other swimmers in the PhilSwim competition have noted that they were impressed with the unique design and its practicality. A (left) has stated that “it definitely felt like [she] was putting effort like [she does] with regular paddles, but there was less tension on [her] shoulders making it easier for [her] to swim with. It also forces [her] to correct [her] form such as keeping high elbows.” (Image 1). As for subject 2, R, he had “no problem with using the paddles and the placement of the finger strap allowed [him] to correct [his] water entry and catch.” (Image 3). Additionally, they were surprised with the price point of the paddles as it will be sold at 70 pesos, making it more economical and inclusive to the majority of the swimming society in the Philippines.

Images removed for copyright reasons

Suggestions mentioning that:
- Paddles should be catered to different hand sizes
- Donation boxes for goggles should be presented in swim centers to collect used straps
- Personalizing a finger paddle for a specific team could widen the audience such as the “Alabang Gators”

The unique paddle structure has made a helpful impact to around 40 members of the PhilSwim community as they all found the paddles easy to use and this meant less tension on the shoulders, preventing injury.
Evaluating design and market specifications

**Aesthetic Requirements:** The overall aesthetic was simple and practical towards the target market as it presented a minimal structure that looked different from the other competing products.

**Size and Cost Constraints:** 85mm x 95mm x 3mm was the measurements after laser cutting, showing that the size was kept the same. Also, the cost of the product is at 100 php, making it cheaper than the cheapest competing product by 277 php.

**Customer Constraints:** The prototype only comes in one size at the moment, but the sizes will vary in able to accommodate more customers.

**Environmental Constraints:** The paddles are made out of acrylic plastic, which can be later recycled, and reuses old goggle straps to give them another purpose.
Safety Considerations: The paddles have a flat surface and the corners have been filed down to curve the edges. Plus, its light weight and surface will not cause physical injuries such as swimmer's shoulder.

Performance Requirements and Constraints: A field trial was conducted and the finger paddles performed its function well. It acts as a swimming aid by strengthening and enhancing the swimmer's stroke whilst preventing a cause of shoulder injuries.

Materials and Manufacturing Requirements: The same materials (acrylic plastic and goggle straps) were used to create the prototype by using the laser cutter showing that these requirements were kept constant.

Target Market + Target Audience: The market is still targeted to a wide market of avid swimmers ages 8 to 55, but the product achieves the goal of being available to an audience that cannot afford such swimming aid as this product is priced at 100php.

Market Analysis: Different colors and sizes would be a useful way to market the product to different audiences, such as to swimming teams or swimmers with smaller or larger hands. Additionally, more designs such as laser engraving the paddles can attract different audiences by marketing a favorable trait in the paddles.

User Need: The purpose is to create a paddle that is economical and affordable to a large market by being cheaper in price whilst helping correct stroke technique and lessen the pressure on the shoulder joint. This will help prevent swimmers from gaining any sports injuries in training.

Competition: Finis, Speedo, and MadWave are all competing brands for this finger paddle. What differs my design is that it comes in a different structure compared to the three brands, and is sold at a cheaper price.

Conclusion

To conclude, the process of the design cycle in this essay was important since it played a major role in structuring and guiding this essay, and helped me in undertaking design projects. It also gave me a greater
understanding of swim aids and how they can prevent injury through ergonomics whilst improving the quality of swimming for users. Whereas the research gave me more knowledge on how to make a product more economical. From the final product, I was able to make a more ergonomic and economical finger paddle that addresses the solution of preventing shoulder injuries, helping form correction, and being affordable to a wider target audience, such as those who cannot afford such swim aid. With my background as a designer in the Philippines, I believe that my passion for swimming and my country has given me the ability to design and improve swimmer’s lives.
Bibliography


Image Sources:


