

Sheridan College  
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# Introduction

Noticing how life jackets keep you afloat but cause you to struggle to breathe and swim properly,

I want to solve this by designing something that will keep kids afloat high enough so that their nose and mouth do not go underwater (even in an unconscious case) and that their arms and legs can move better.

The focus is more on their swimming abilities than saving them from drowning, but there are features added in case of emergency, as a back up.

A device that kids are encouraged to wear while swimming, that does not limit movements.

My focus on finding a better solution of keeping kids afloat while swimming by avoiding choking from the device, and making it less thick so that breaststroke, kicking, front and back crawl are easier to perform.

Focused swimming as opposed to life saving

Outdoor Waters (oceans, lakes, etc. as opposed to indoor or outdoor pools)

Boys and Girls

Ages 4 - 9 years old

Give your limbs more accessibility to movement as opposed to focusing on them floating until help arrives

Independence in saving themselves

# Problem and Reason for Topic

I want to make a product that helps children stay afloat while easily being able to move limbs while swimming.

I want to solve the problem of lifejackets choking children and hindering their swimming abilities with their limbs. I want to make something that helps children stay afloat while allowing them to easily move their arms and legs to swim. I felt this as a child and it was a problem that really irritated me. I want kids to feel encouraged to wear it when needed on boating and in swimming lessons.

My focus would be on:

Boys and Girls

Ages 4 - 9 years old

Give your limbs more accessibility to movement as opposed to focusing on them floating until help arrives

Focused swimming as opposed to life saving

Outdoor Waters (oceans and lakes as opposed to indoor/outdoor pools)

# Methodology / Research

- life jackets have certain pfd levels - this affects how long they float for and how well
- take good care of them; pressure from knees or canoes will damage them quicker, and store properly to dry to avoid mould and ripping of fabric. <sup>1</sup>
- bright colored life jackets are there to make the wearer easily visible by boat, shore-line, or aircraft.
- kids struggle with so much complexity in straps and buckles, dependent on adult help
- pfd foam can last up to ten years or longer when taken care of properly<sup>2</sup>
- body warmth does not decrease right away<sup>3</sup>
- bodies need more floatation on the stomach and back
- your stomach area weighs you down
- children average weight: 55 - 80 lbs
- weight affects how much pfd foam you need
- you weigh a lot less in water, so you don't need as much floatation as you might think
- choking when wearing them as the pdf foam causes it to float past the mouth and nose, making that part of the face to go underwater
- pillow for backing is a nice support for head in case they get knocked out/run out of energy
- lose energy faster in the water, so dependent on a life jacket or floatation device
- different forms of lifejackets that are already out there: just around the head, waist, just on the front, and water wings
- avoid choking or item going past head
- played with tube like shapes
- wanted to avoid leg straps in between legs
- less thick
  
- simple fastening method - avoiding zippers and many straps

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1 <https://www.boatingsafety.com/blogpost/1828549/341273/Tips-for-Cleaning-Life-Jackets>

2 5 Reasons to wear a lifejacket, Red Cross Canada, Accessed Oct. 5/2022, <https://www.redcross.ca/blog/2017/6/5-reasons-to-wear-a-lifejacket>

3 <https://ebsadventure.com/blogs/news/when-should-you-replace-your-pfd-and-why>

- choking when wearing them as the pfd foam causes it to float past the mouth and nose, making that part of the face to go underwater
- pillow for backing is a nice support for head in case they get knocked out/run out of energy
- lose energy faster in the water, so there is dependence on a life jacket or floatation device when out in the water for long<sup>1</sup>
- different forms of lifejackets that are already out there: just around the head, waist, just on the front, and water wings

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1 <https://ebsadventure.com/blogs/news/when-should-you-replace-your-pfd-and-why>

# Brief / Objective

My goal is design a device that encourages kids to be safe in the waters. I want an item with thin layers of foam, comfortable with a neckline that doesn't choke you, and something that can easily be put on or take off. It would not be awkward in or out of the water when wet, and would not hinder arm or leg movements when swimming. My focus on finding a better solution of keeping kids afloat while swimming by avoiding choking from the device, and making it less thick so that breaststroke, kicking, front and back crawl are easier to perform.

# Competition / What's out there



Figure 2



Figure 3



Figure 4

- lifejackets
- water wings
- life vests that wrap around the head only
- life vests that hang only in the front, with straps and a headpiece on the back
- one bathing suits for kids where the foam is sewn in around the waist in a
- circular form

Figure 2 - <https://blog.heartmanity.com/do-water-wings-ensure-or-endanger-your-childs-safety>

Figure 3 - <https://www.stevestonmarine.com/boat-safety/boat-life-vests-and-pfd/children-life-jackets>

Figure 4 - [https://www.mec.ca/en/product/6017-003/crew-child-pfd?gclid=CjwKCAiAy\\_CcBhBeEiwAcoMRHKTRp5EEqaQH-g1xd0-1Q3yQfO7R4Ed9eoVMUsRRFcCdjjURYa4bR0hoC-FIQAvD\\_BwE&colour=Green%2FGrey](https://www.mec.ca/en/product/6017-003/crew-child-pfd?gclid=CjwKCAiAy_CcBhBeEiwAcoMRHKTRp5EEqaQH-g1xd0-1Q3yQfO7R4Ed9eoVMUsRRFcCdjjURYa4bR0hoC-FIQAvD_BwE&colour=Green%2FGrey)



# Synthesis Research Analysis

Based on my research, I found that this is a common problem when swimming for others. I have had a lot of positive support with Concept 1, which is really a source of inspiration from thinking of different ways to physically supporting a person in deep water. I found other ways to avoid the in between leg strap, certain fasteners, and explored different bright colors.

# Results

This means that too much foam around the neck can be uncomfortable. Something with a lot of material could prevent more body heat from escaping and could be flatter so that more foam can be used to keep kids afloat. The headrest is used, as noted in class, for kids to rest properly, as well as a hook to need to be rescued if needed. It needs a sturdy, water proof fabric to prevent ripping and mould. Bright, warm colors would contrast the ocean's dark blue waters and be very visible for parents security, and when in need of rescuing,

# Early Models



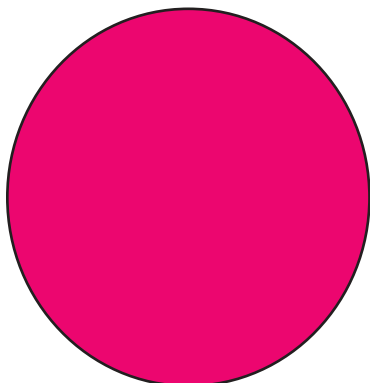
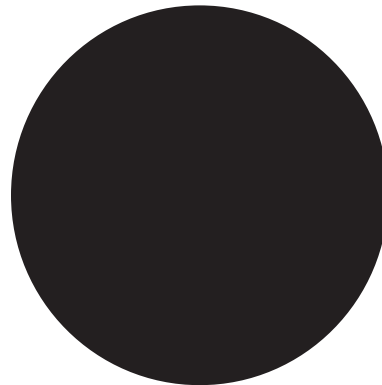
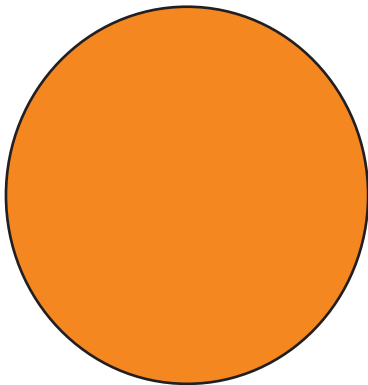
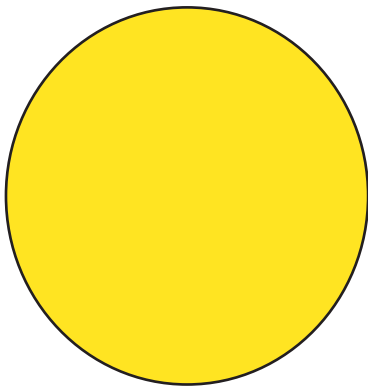
These helped me play with formations of floatation around the body.



# Color and Material Objectives

The color of the water-proof fabric covering the foam would be bright for easy visibility of children in the water, and warm colors to contrast the blue water and sky. The suit would be black as a calming neutral color so that it is not too blinding color-wise, and to add some maturity to it which encourages kids to wear it. Bright colors and fun shapes designed to resemble armour are to showcase it's target market.

I plan to use a bating suit / nylon spandex material for the colorful oarts wrapping the foam, and a sport nylon for the black suit.



# Interviews

## Interview 1 - Swimmer with Lifeguard Training

What do you like about life jackets?

General safety, knowing if you fall off or out of the boat that you're not there too long: I won't drown. Bright colours, so anyone easily spot you out there if trying to stay afloat.

What do you dislike?

-consider lack of mobility, especially upper torso, walking around t-posing, super uncomfortable, chest is pulled up to head, upper torso can't move, head fixed.

-straps, how do they work? Visual aids? Have lifeguard do it

Do you ever avoid it when you should?

-avoid wearing it buckled up.

-leaning/bending forward is difficult, back straight.

What water sports/events do you do?

Water polo, lifeguard training, swimming lessons competitive holding breath, (To save/pick people up, bring people back, CPR) cut straps quick access- chest compressions.

What do you notice positive / negative about kids lifejackets?

Over rely on them, won't properly learn to swim. Lack of motion.

Everything else is pretty good. Head room struggle. Handle near head.

## Interview 2 - Swimmer

Do you use life jackets?

I used them in areas where required. Lakes, deep seas areas. I was taught enough swimming to not drown by 7 years old.

Do you swim a lot?

Lazy swimmer – did not move too much, especially in the deep end. I mostly hung around the edge of the pool. There was not so much effort in swimming or moving my body. At Calypso you lose stamina - there is a struggle in the depleting waves at the wave pool part. A lifejacket minimizes movement. Different designs, that ride up in face, hold it down, want to use arms, rely on legs which get more tired.

-can wear as diaper - centre of gravity

-boards surfer -paddleboards

Something separate is better than wearing a loose object; it's more wearable, secure and deal. It's not too poofy or thick. It also is hard and annoying in the water when it rises.

Do you wear one when you should (boat rides, water activities)?

Depends, on boat rides if I'm told I have to, strictly, then yes. But even on a speedboat; I'm not an idiot - trust the driver of the boat. If no one says anything, then no.

Do you know any children who swim?

Little cousins; clunky, too thick to use bodies are smaller struggling to swim because they're still learning flailing around. Have to use in deep water, flailing in hopes of moving, or rely on moving them. Hold them push them or separate floating toys or tubes.

## Interview 3 - Swimmer

When did you have to wear lifejackets as a kid?  
(swimming, precautionary on a boat, etc.) When on a boat when I was really young and while tubing or water skiing

When do your kids/young siblings/young cousins, etc. wear life jackets?

Don't know young kids right now

What are things that have gone wrong where luckily someone was wearing a lifejacket of some kind?

Family friend's child was flipped over on a knee board under water

What do you or others find irritating about life jackets? Bulkiness

What is a feature you like about lifejackets?

It keeps me afloat

What do you do on the water activity wise?

Boating / Canoeing

Do you wear a life jacket or floating device of some kind when doing those activities? Yes

Do you avoid wearing life jackets when you should? If so, why?

On boats and paddle boards I don't have to wear one so I don't but I have one with me. Because they are uncomfortable.

What's your price range for life jackets? \$50-100

## Interview 4 - Swimmer

What are the positives features of life jackets, according to your experience?

I had more water wings, which I really liked. I also loved wearing them when being thrown into the pool, and float up back up after touching the bottom (not harshly thrown in).

What are the negative features?

Uncomfortable on the arms, rubbing, seam hurts from swimming specifically. Plastic on plastic. Not uncomfortable with the straps.

Do you go in the water? What do you do to float?

For the ocean, or I wear noodles to float. I wear lifejackets if I have to, mainly on boats.



## Interview 5 - Swimmer

Did you wear a life jacket as a kid, if so when?

On boats and swimming lessons when teaching when learning how to swim... I also taught swimming lessons and we would teach the kids about life jackets (how to put them on).

Are there kids in your life that wear life jackets? If so, when?

When on boats, kayaking, paddle boarding

What is a negative feature to a life jacket/floating device? They are bulky and stiff, and they take up space when bringing portaging.

A positive feature? It floats.

Do you wear a floatation device of some kind during any of those activities? No, I don't wear life jackets because they suck! They take up too much room, limit my mobility, are too stiff and look stupid.

How much money would you spend on a life jacket/vest?

I don't think I'd ever purchase a life jacket... but no more than \$30

## Interview 6 - Swimmer

Did you wear a life jacket as a kid? When? Boat, water skiing and water tubing — as an adult and child

Do you know any kids that swim? When do they wear life jackets/ vests? When On boats, kayaking, paddle boarding.

Did you witness/experience an incident when someone was luckily wearing a life jacket?

Losing balance when water skiing and getting dragged.

What do you dislike about life jackets?

Size — I wear an XS as an adult. Most adult life jackets don't fit well.

What do you like about life jackets?

Safety. Some of the colours (ie. pink) can be nice.

What do you normally do in the water (activities)?

Snorkeling.

Do you wear a life jacket/vest for that/those activities? Yes except for swimming.

Do you avoid wearing life jackets when you should? No.

How much would you be willing to spend on a lifejacket? \$50 if fit properly

# Interview 7 - Amazon Reviews

Looking at 1-3 star reviews, what was wrong with this life jacket?

- cuts into arms
- armholes too big/size affective
- goes past mouth/nose
- doesn't hold air
- not safety certified
- zipper problems
- poor quality<sup>4</sup>

## Interview 8 - Swimmer

What do you like about life jackets?

They are effective on keeping head upright, at least in calm water, and I like all 4 buckles.

What do you dislike?

Uncomfortable, never feel like they fit snugly/form fitting, which is important to me. Weird that it covers upper chest when it should cover whole torso.

I'm worried about face first in water / unconscious. It's a painful process, why not like shirt size?

How often did you try on life jackets?

Every day, but it's like a 15 minute process with everyone.

They are ugly and stupid, and need to be more colourful. No dullness, brighten them up, and make them reflective.

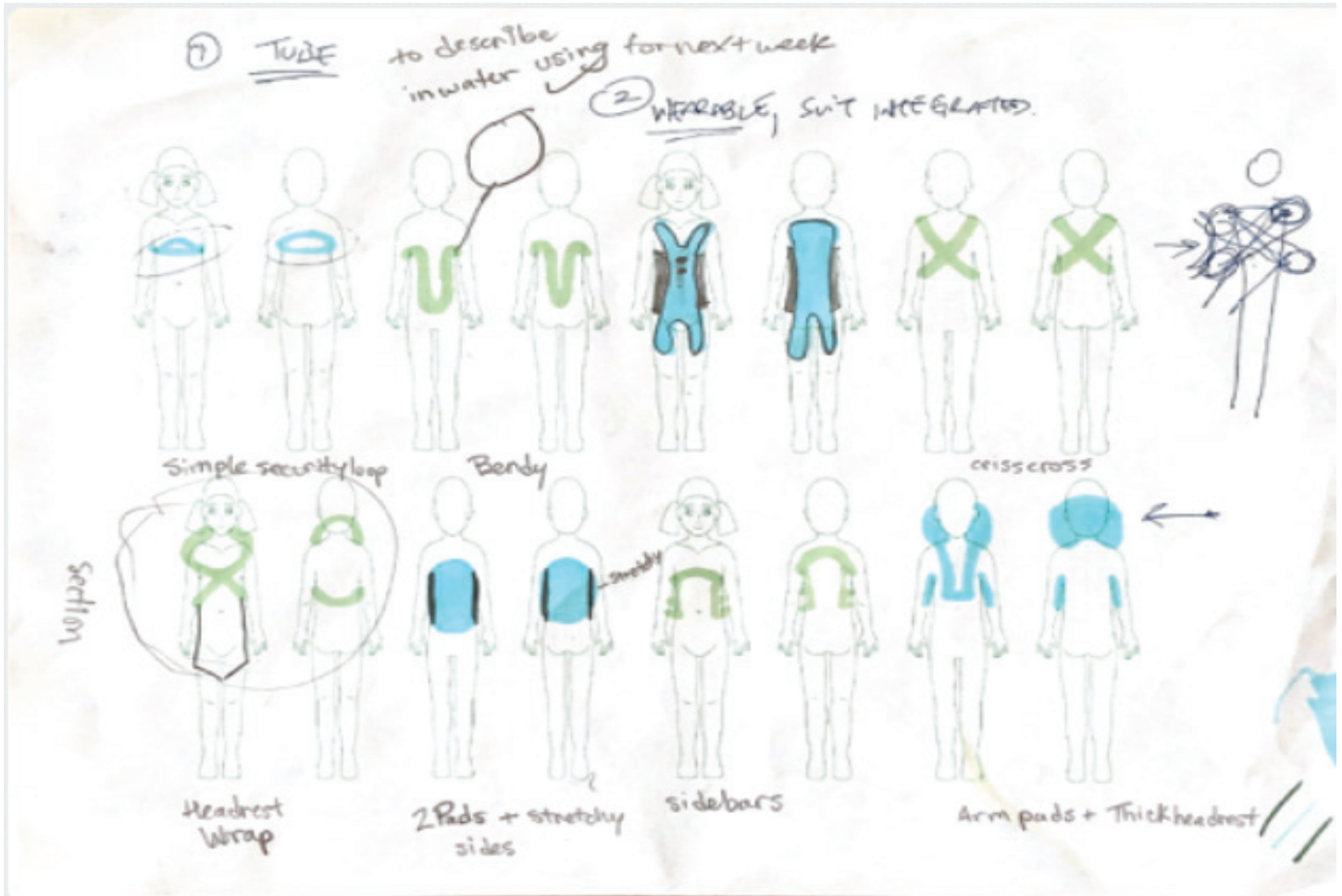
Straps are too long and dangle too much; too much slack.

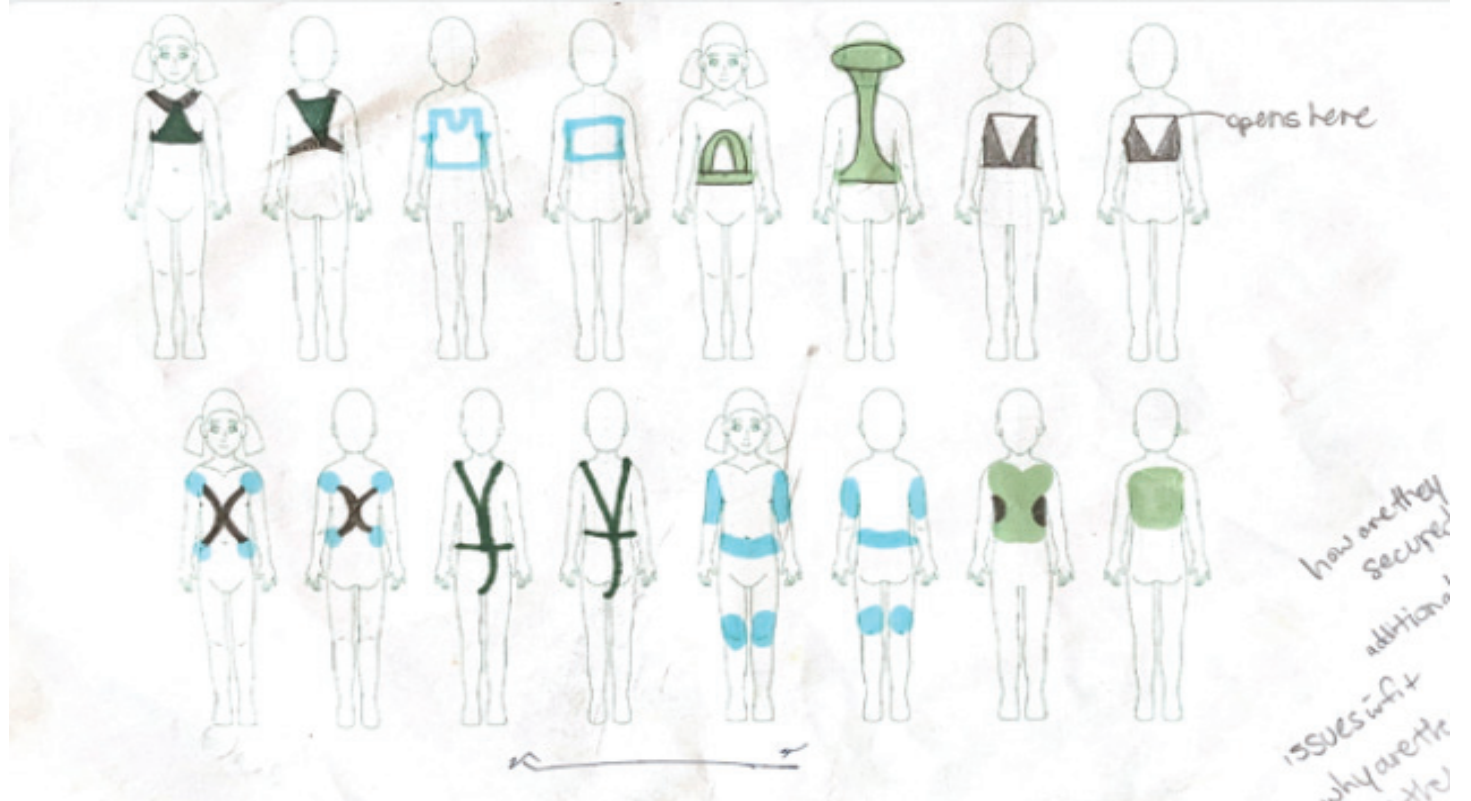
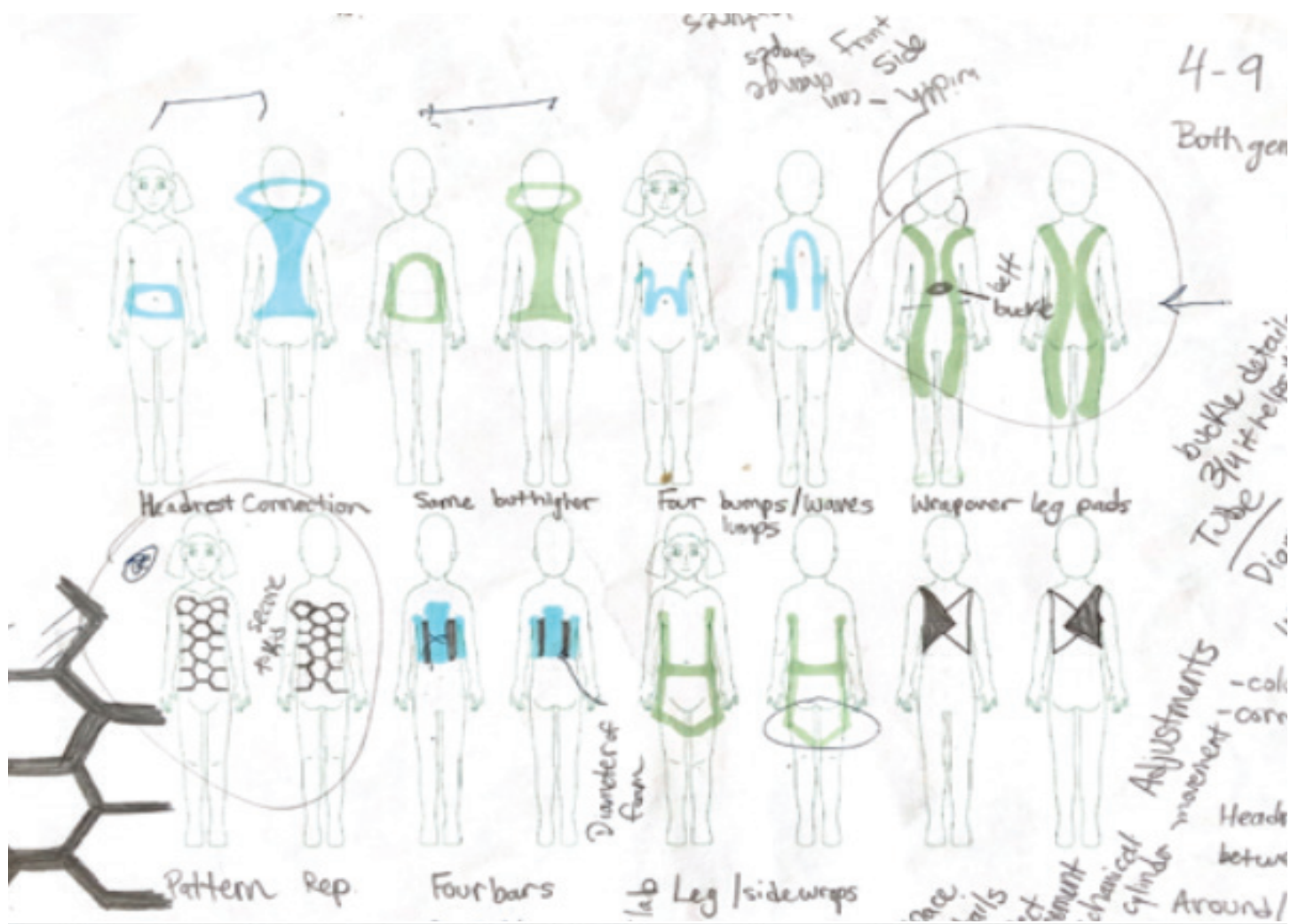
Weird smell, feels weird when trying on wet.

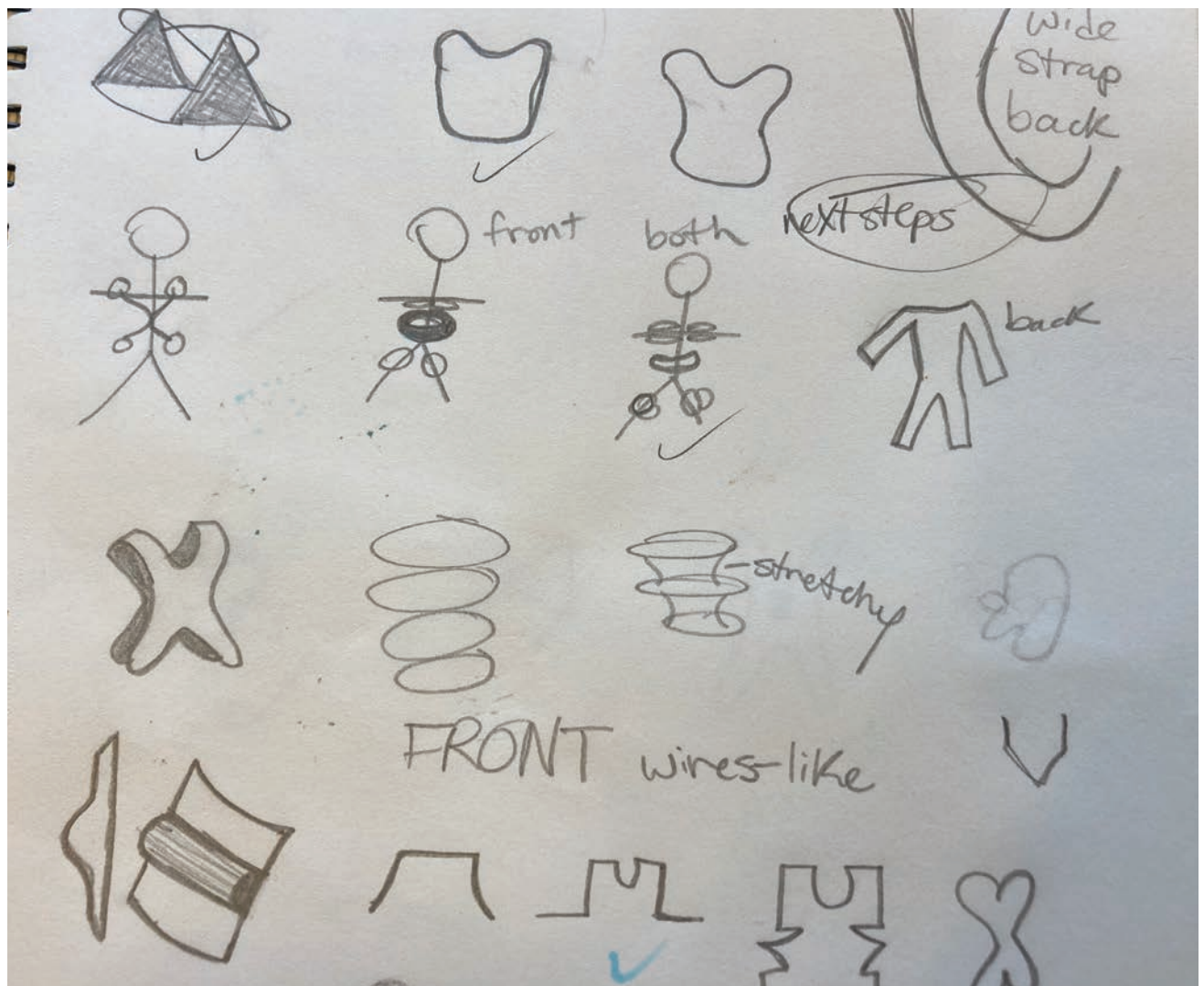
Feels like a blood pressure test the whole time. Irritating gap when you buckle up; want to close completely.

# Ideation

Every two figures in the same color/s is a front and back representation of one idea.

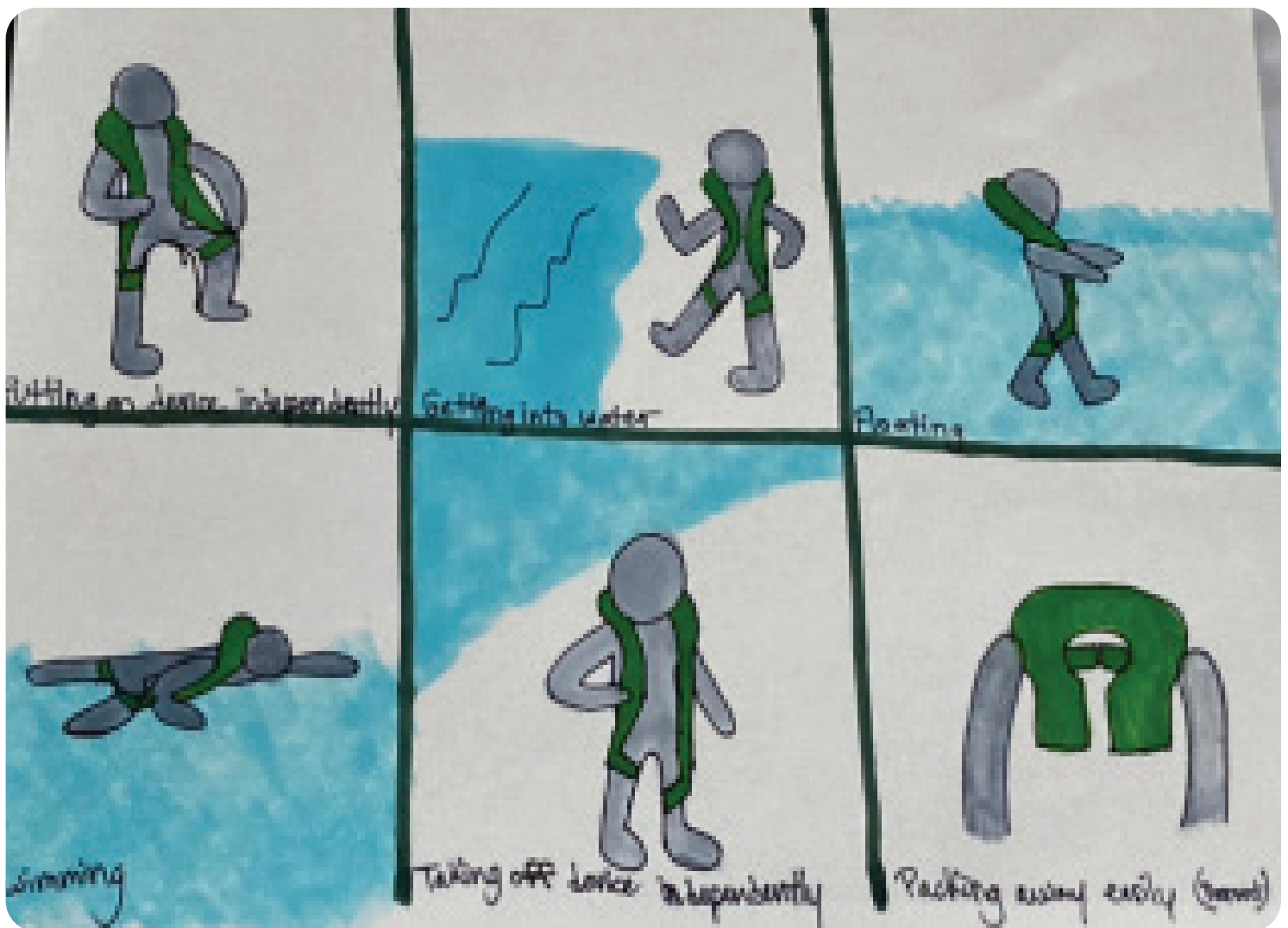






# Storyboard

Storyboard of an early concept, but is still a general vision of product through the seminar semester. It demonstrates how to put it on, its use (swimming), taking it off and storing it away. While this idea is not the final concept, this storyboard still shows the general use of it.



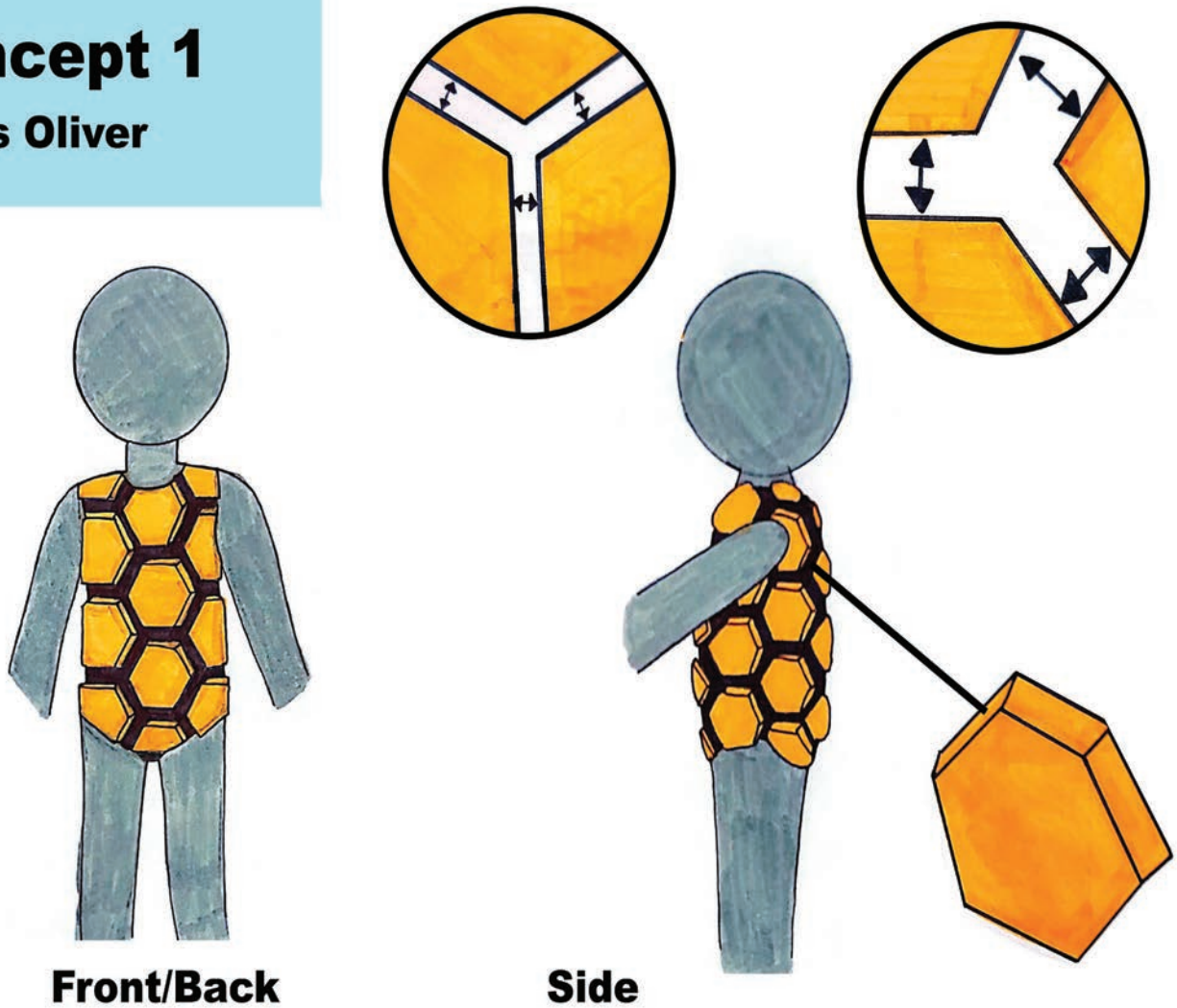
My drawing of my storyboard



# Three Concepts

## Concept 1

Carys Oliver



**This product is put on like a one piece bathing suit. PFD foam is cut in hexagon shapes, wrapped in water proof fabric, and sewn together with stretchy fabric for different sizes of kids, and overall growth.**

My drawing of Concept 1

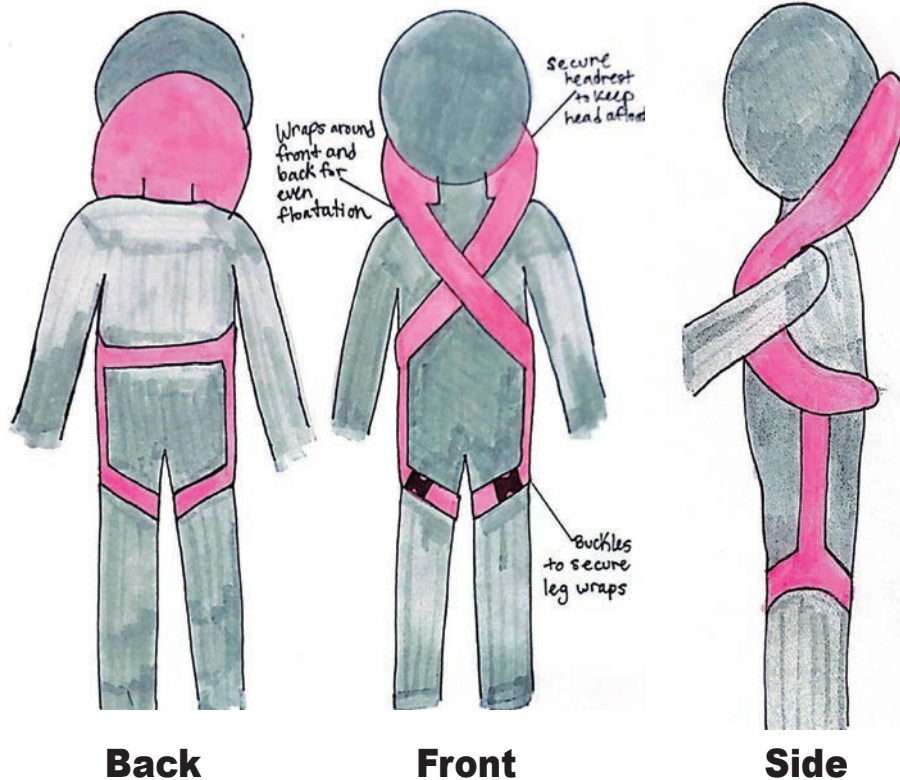
Concept 1: A stretchy suit with hexagon shaped foam.

This fits on like a one piece bathing suit. The pfd foam is cut into hexagonal shapes, sewn into the stretchy one piece bathing suit. There are no foam pieces in between the legs.

## Concept 2

Carys Oliver

The bright, light warm colors help with visibility in case the child is in need of rescuing.



**This product is put on overtop. There are clips around the leg wraps that are fastened once the top is secured. The focus was to have bouancy material wrapped around the front and back evenly. The leg wraps are to avoid the awkward single legstrap in between the legs.**

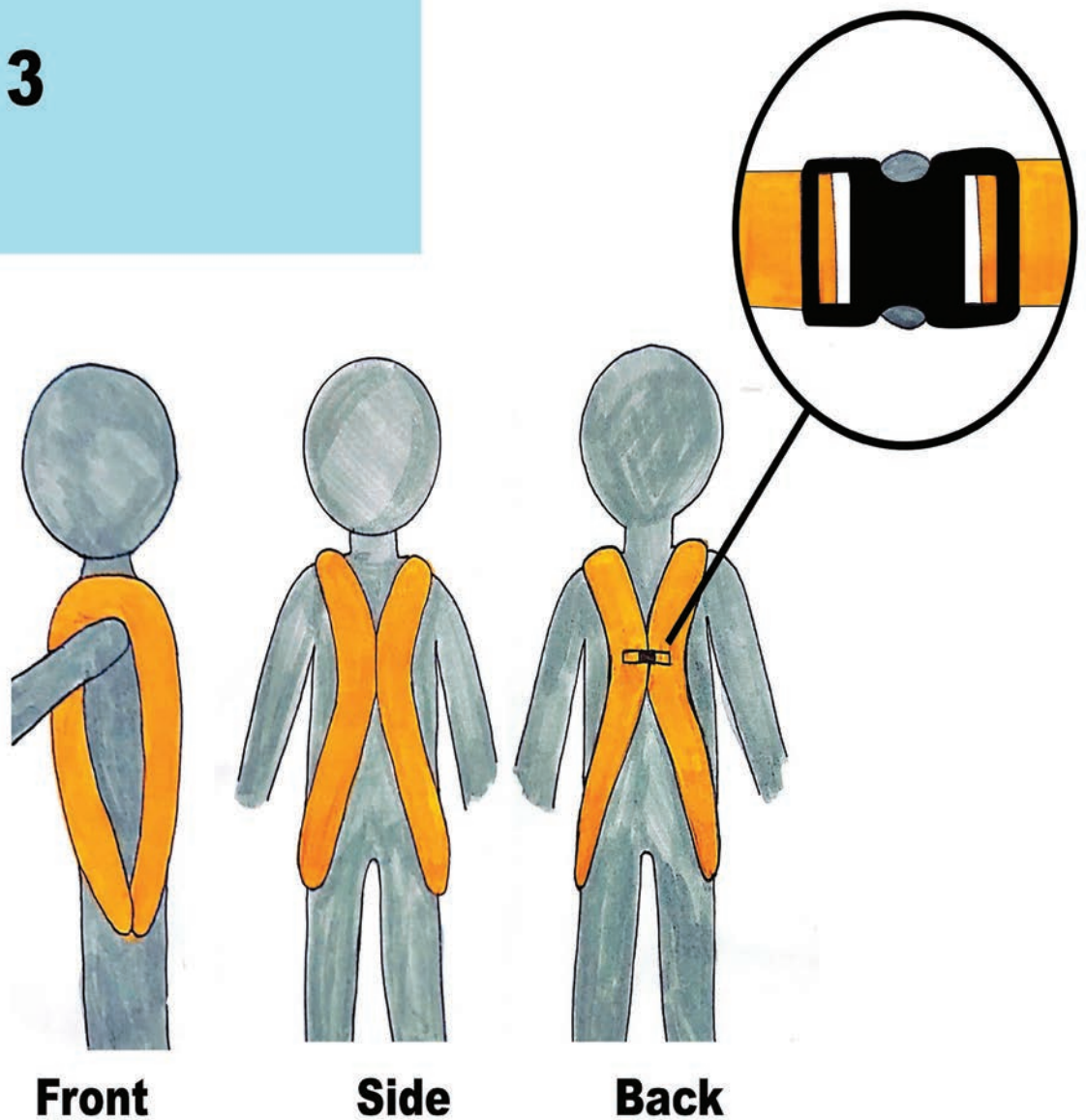
My drawing of Concept

Concept 2: Tube-like with straps on the legs, and a headpiece.

This one wraps around the body with secure straps around the legs to avoid the in between legs strap. There is a headpiece to help when they need rest.

# Concept 3

Carys Oliver



**This product is put on like a jacket and clipped with the singular buckle in the front. PFD foam wrapped in waterproof fabric with a light orange color to help be seen.**

My drawing of Concept 3

Concept 3: A symmetrical front and back that holds onto the legs.

This was an attempt to avoid the leg strap, and to properly balance the foam on the front and back.

# Final Concept Direction

I decided on going in the direction of a suit, whether it is the full piece or a smaller piece you can already put on while wearing a bathing suit. I want to play with more shapes and bright colors while sticking with a gender neutral theme.



My drawing of my final concept



My drawing of my final concept

My advancement in my concept allows the foam pieces to be bigger, and adds a headpiece. Based on my feedback for Concept 2, the headpiece needs to be smaller so it weighs less. I based the shape on cradling the head enough without weighing to much or having an awkward amount of material. Further research will involve studying more foams and waterproof fabrics, and testing out different shapes.

# Final Semester One Presentation Feedback and Self Reflection



Moving forward, I would like to further explore different sizes of foam shapes and how the pattern will repeat itself throughout the one piece, as well as waterproof materials, and a half piece top or shorts to better suit a male audience (not attached in between legs) based on the feedback I received from my final presentation.



# Four Models





Here I came up with four experimental directions as to how to wrap foam around the human body. One was a triangular folding pattern in the form of a vest. The one below was a simplistic approach as an attempt to not over-complicate the design. It gives floatation where it needs it mainly, and leaves room for arm movement.

The one above on the left played with a different shape but the same repetition. More foam in the middle that decreased as it went out. The final one here is the direction I moved into: repetition, the same shape, and bigger pieces more centered.



# Testing / Validation



This mannequin helped me to test what parts of the body required the most floatation. Using a floatation material (pool noodles), I taped it the mannequin in different ways to see where I should put the floatation pieces. This helped back up my research on more weight being in the stomach area, which why I later added the bigger rounded pieces to the stomach and lower back. I also got in this tub myself with a foam sheet and noticed that a flat surface propelled me to the surface more, and was required way more in my stomach area.



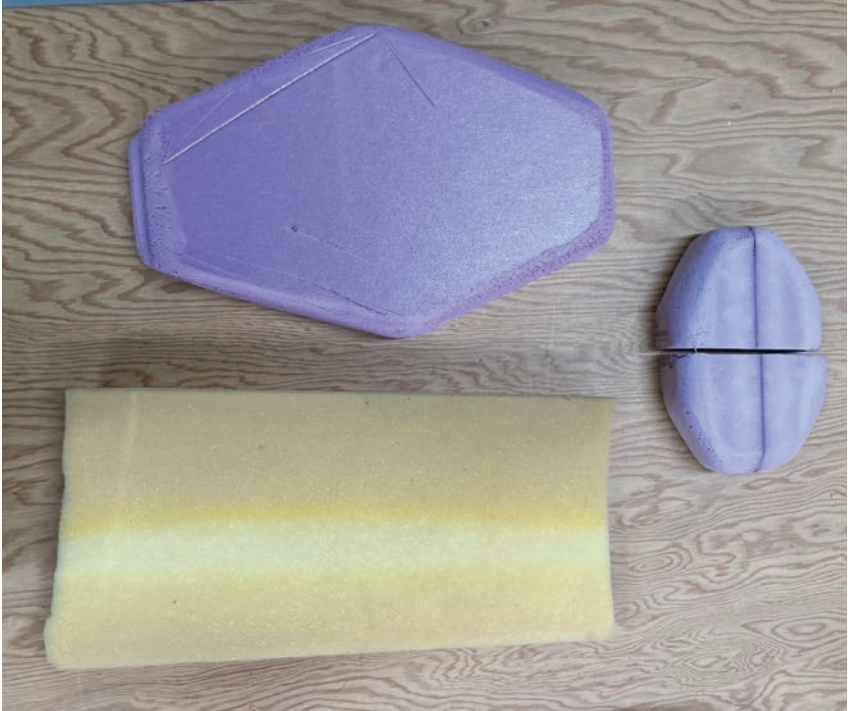
# Sewing Tests / Model Developments



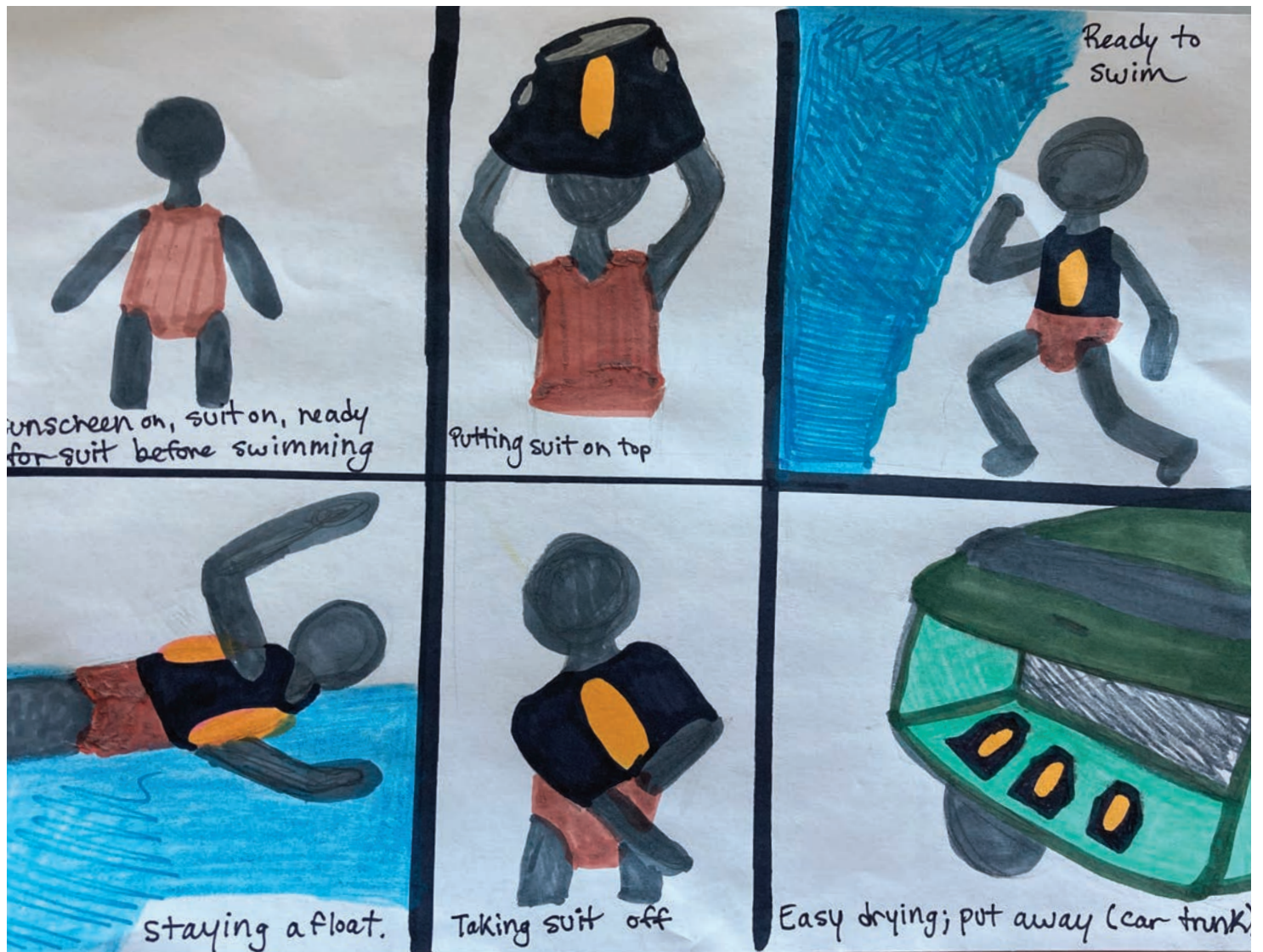
# Moderation



Here was a moderation of the shapes when one shape on the front and one on the back was taken into consideration. Different foams showed different variations of thicknesses for the product.

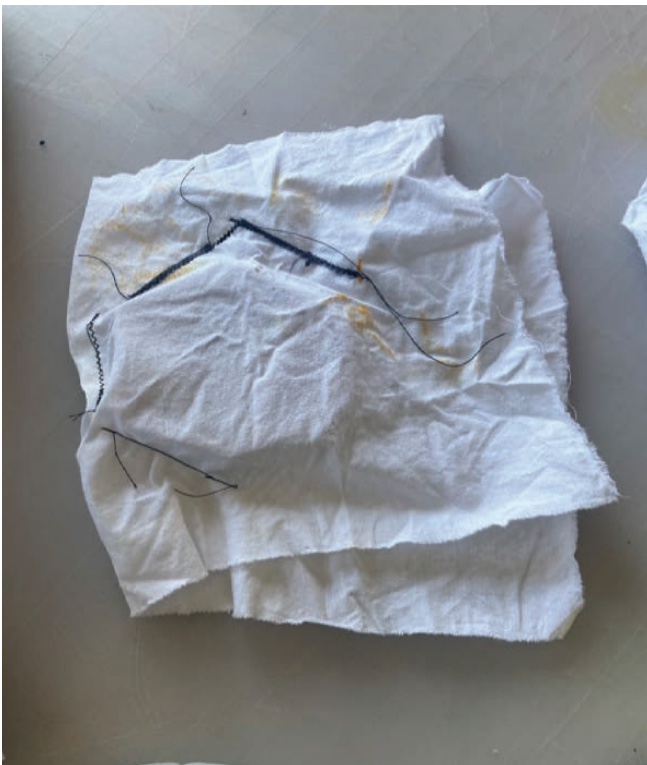


# Updated Storyboard



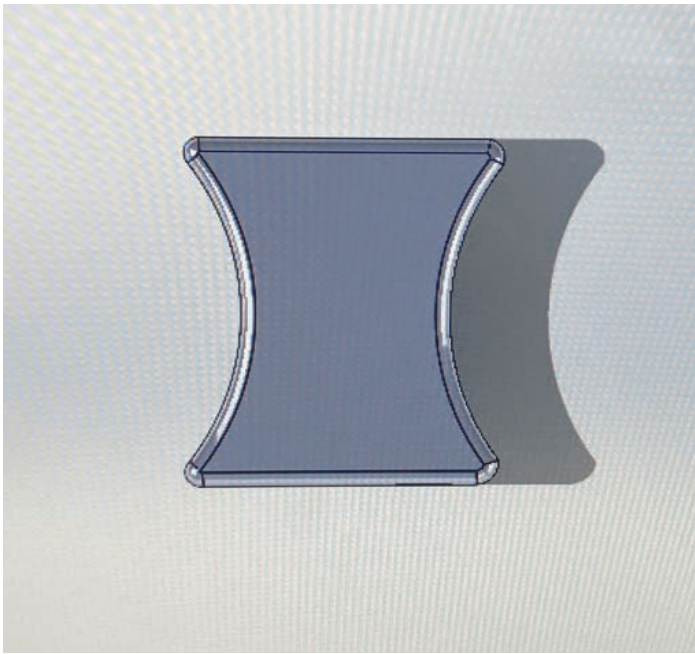
Here this storyboard illustrates a child going to the beach, easily putting it on, going to swim, swimming easily, and then easily taking it off and storing it to air dry in the back of the car.

# Rough Models and Testing





Here I experimented with muslin on the back as a rough exploratory model to see how I could enclose foam between two fabrics, the muslin being on the back.



After many tries, I was able to really cut out the foam correctly to get a curved shape. Through this process I couldn't sand the foam or bandsaw the edges, so it took some precision with scissors.

In the weeks following Reading Week, I tried different methods of sewing the fabric onto the other. Here my photos show folding the fabric over and sewing a seam. From there, I sewn those folded parts onto the suit itself.

This was for the black rectangles and the yellow shapes.

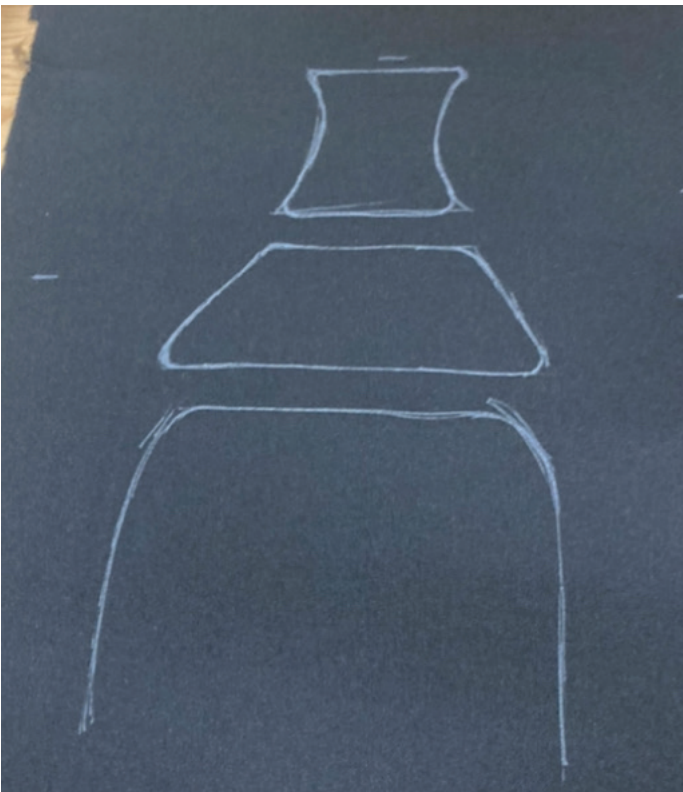


My main method was cutting enough fabric around the foam pieces that it could cover the sides. Here the circle cutter came in real handy. Seams were sewn on the black fabric for the neckline, sleeves, and hems.





# Process



Here for the process, I drew with white marker the outline of the foam shapes that were to be sewn on. The front and back pieces are separate, and sewn together when the foam pieces are on. This is how I know where to sew what pieces on.

For this model, I drew the specific foam pieces on the front of the suit, and the back. Both require different shapes due to shoulder blades and flotation distribution near the neckline.



I sewed the yellow nylon on to the black fabric, I had to turn with the circular corners. I would then sew three out of four of the lines of each shape on each piece the yellow fabric onto the black fabric insert the foam and then sew it in with that last line.

It was difficult to sew in with the foam is due to the thickness a part of the needle/machine what keep hitting the foam in an irritating way. It was then decided for a discussion with my mentor that I could 3-D print these.



# Final Concept

For my final concept, I want two big pieces for the stomach area; one on the front, and one for the back.

For the piece above I want it to frame the bottom like armour would, by being rounded. The top back piece will be a quadrilateral with parallel top and bottom lines, and indented curves on the sides for the shoulder blades to come in.

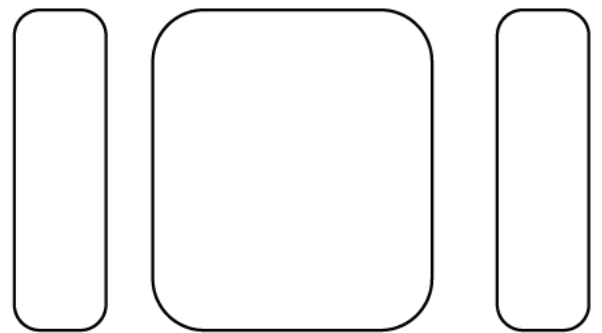
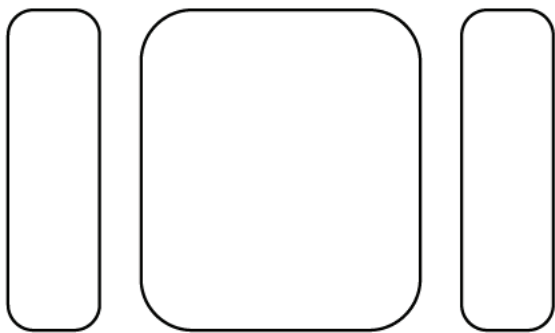
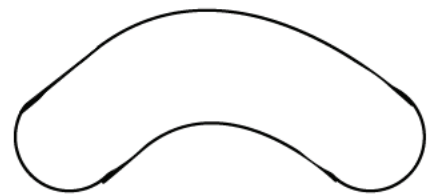
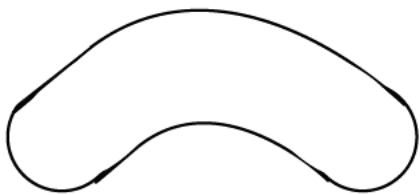
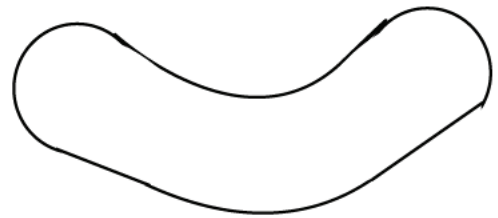
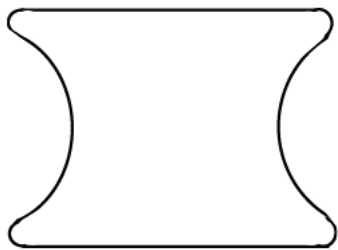
The top front piece will bend in the opposite direction and be a bit bigger, going along the neckline seam.

All are sewn onto the black fabric to make up the suit, in two pieces; a front and back.



Figure 5

# Sewing Pattern / Foam Layout



Back

Front

# Final Model / Solution to Problem



Front



Back

I cut out different shapes of foam with slightly different thicknesses to insert into the yellow fabric. What I would do is cut two pieces of black fabric for the suit; one for the front and one for the back, after drawing white outlines of the shapes on them to where the flotation needs to be.

I went to Fabricland and bought a bathing suit material that came in yellow (nylon spandex) to cover the shapes and a sport nylon fabric in black for the suit. I didn't want the product to be too much yellow so I decided that the side bars should be sewn in black.

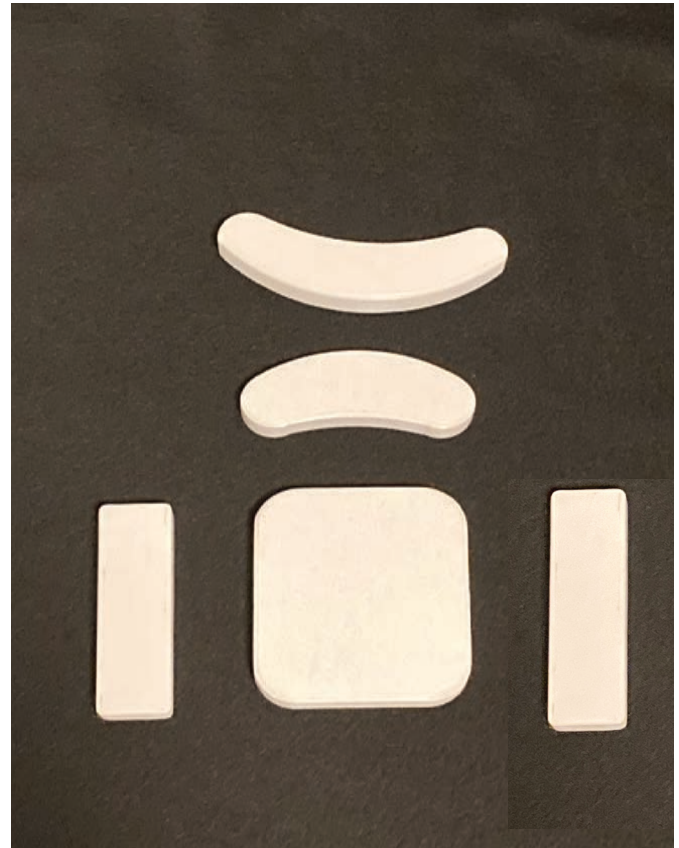
With all the many pieces I wanted them to have 1 inch gaps inbetween in case ropes from nearby boats got caught up in them, so that they don't remain stuck, but easily come out.

# Functions and Life cycle

- easy to do front crawl, back crawl, breaststroke, kicking, and breathing
- thin enough that it is comfortable to wear and kids will not avoid it
- shapes and colors that kids like, and make visible from far away in the water
- a suit that fits around the chest for best floatation to easily put on top of bathing suit
- stretchy fabric for ages 4 - 9 years old and different sizes of kids
- kids could have for 1-2 years before it's a hand me down
- with pfd foam and thickness and care, could last up to eight years total based on foam lastness



# Features



The upper curve highlights the collar seam and seeps into the shoulder sleeves.

The smaller downwards curve allows more arm movement during strokes and is shaped to frame the piece below.

The biggest piece is placed on the stomach as there is more weight in the stomach, and therefore requires more floatation. Also, your shoulders tend to naturally come up to or above the water level so there's less foam required there.

A bar on each side on the biggest piece adds floatation to the waist / stomach area, but was concealed in black fabric to give it a more mature look. There are four bars on the entire suit, adding up to ten foam pieces in total.

The quadrilateral is shaped to not interrupt the shoulder blades during swimming.

Below is the same curve as on the front, to frame the bottom piece.  
The same big piece is repeated on the back for equal floatation.

# Self Reflection

I was glad that my that my capstone focused on a problem I wanted to solve. I expanded more in my textile experience. I am still kind of new to textiles, but I definitely practiced more and learned more when it came to incorporating foams and plastic pieces into fabric. I learned a lot about PFD's in flotation and what is required in order to properly stay afloat per size of person.

I really learned how to think outside the box more and not just make a life jacket or vest. to go back further than that and potentially make a suit and other things to take into consideration. I am glad to have had so much time on one project a really Focus on so many details to end up with some thing and at least in a step of the direction of a problem I want to solve.



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# Next Steps

As this is a technically a prototype, I think this is definitely a step in the right path for replacing lifejackets one day. Based on feedback from others, my idea went into a good direction for something comfortable, easier to wear, and therefore more likely to be worn when needed. If kids are more likely to wear a floatation device, then we can all be a lot safer. I know that technically it can't replace a lifejacket for legal reasons just yet, but this can lead to further testing with kids in pools and monitored areas and get whatever tests it needs to be legally considered the new life-jacket.

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# Appendix

Figure 1. <https://open.spotify.com/track/5VFYpUqKVTPSRnlqdUdkpf>

Figure 2. <https://blog.heartmunity.com/do-water-wings-ensure-or-endanger-your-childs-safety>

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Figure 5. <https://unsplash.com/s/photos/kid-beach>