The Thigh Blaster 2000

Engineering Design 100 Section 008
Team 3
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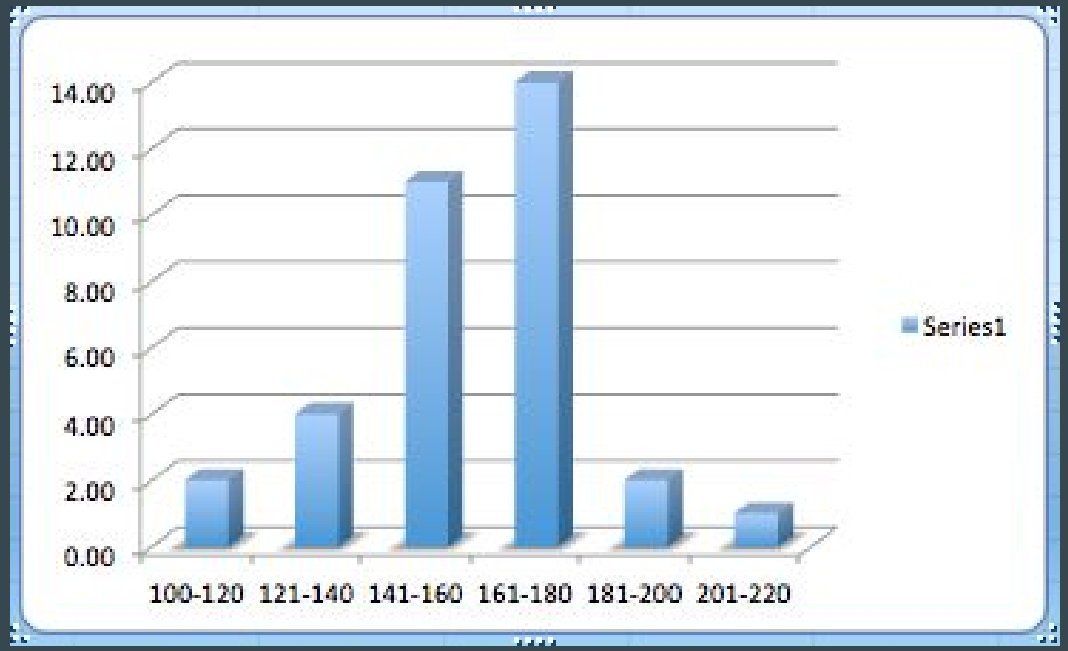
Our Mission Statement...

We recognize the opportunity to design, build, test, and sell a device that can be used by college students weighing up to 200 pounds to walk across a pool with independent foot movements in order to provide a cardiovascular workout that focuses on the inner thighs..

Stakeholder Requirements

- Safety
- Practicality
- Functionality

Our Survey of 34 students showed that most people using this device would weigh under 200 pounds.



Assessing the Needs of Our Stakeholders

	A	B	C	D	E	Row Totals	Row Total/Total
A	1.00	3.00	0.33	0.20	0.14	4.68	0.09
B	0.33	1.00	0.20	0.33	0.20	2.07	0.04
C	3.00	5.00	1.00	3.00	0.33	12.33	0.24
D	5.00	3.00	0.33	1.00	0.14	9.48	0.18
E	7.00	5.00	3.00	7.00	1.00	23.00	0.45
					total	51.55	
A- Safety	9.00%						
B- Durability	4.00%						
C- Light Weight	24.00%						
D- Cost	18.00%						
E- Weight Capacity	45.00%						

Our Design Specifications

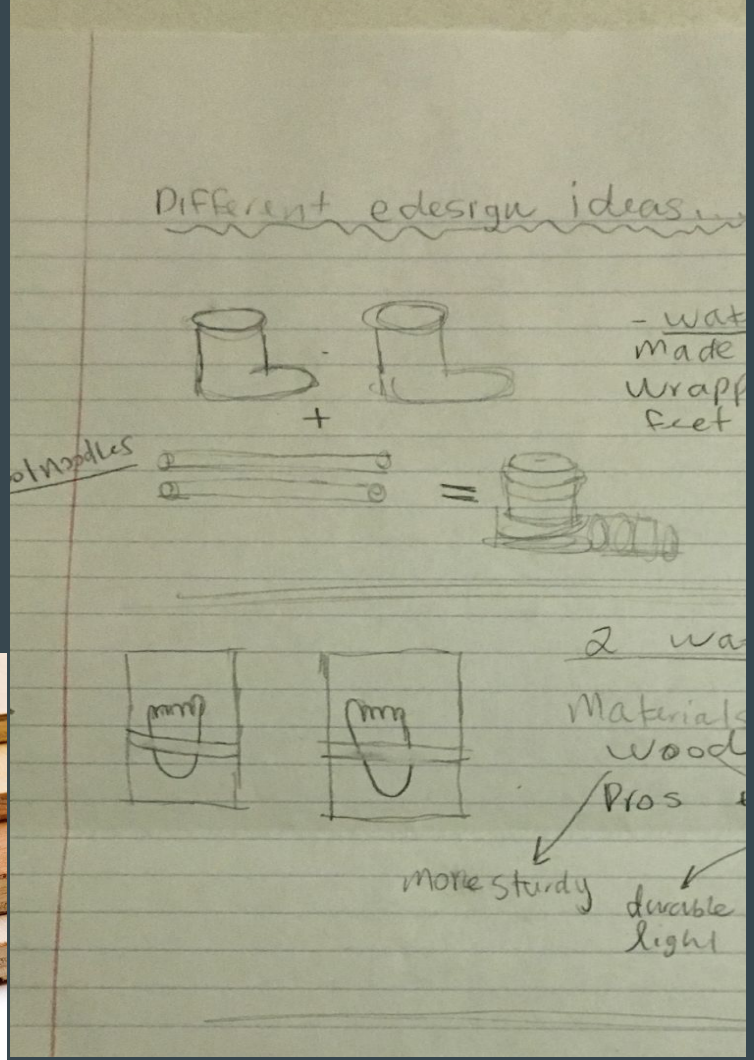
- Weight support of up to 200 pounds
- Independent foot movements
- Device will not touch the sides or bottom of the pool
- Device will not emit and substances into the pool
- Weigh under 30 pounds
- Cross the pool in under 6 minutes
- Must maintain function for 50 hours total in the water

Concept Generation

Fig 1. Image of different options

1. “Noodle boots”

2. “Foot paddle boards”

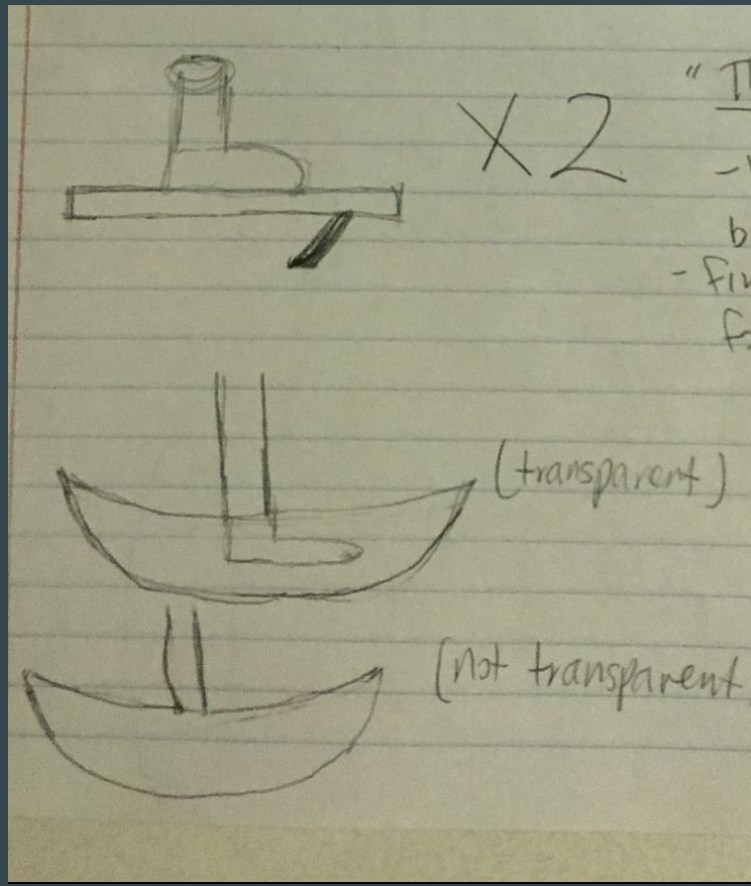


Concept Generation

Fig 2. Image of different options

3. “Water ski planks”

4. “Boat shoes”



Selection Criteria

cost	18%
weight transported	45%
durability	4%
safety	9%
light weight/transportability	24%

Design matrix

Table. 1 Design Matrix

		water rafts		Thick water ski		boat shoe		tube shoe	
selection criteria	weight	rating	weighted score	rating	weighted score	rating	weighted score	rating	weighted score
cost	18%	4	0.72	3	0.54	4	0.72	4	0.72
weight transported	45%	4	1.8	2	0.9	2	0.9	2	0.9
durability	4%	2	0.08	3	0.12	3	0.12	2	0.08
safety	9%	3	0.27	5	0.45	5	0.45	5	0.45
light weight/ transportability	24%	3	0.72	3	0.72	3	0.72	5	1.2
	total score		3.59		2.73		2.91		3.35
	rank		1		4		3		2
	move forward?	no	no	no	no	no	no	no	

In order for the device to float, Buoyant Force > Total Weight.

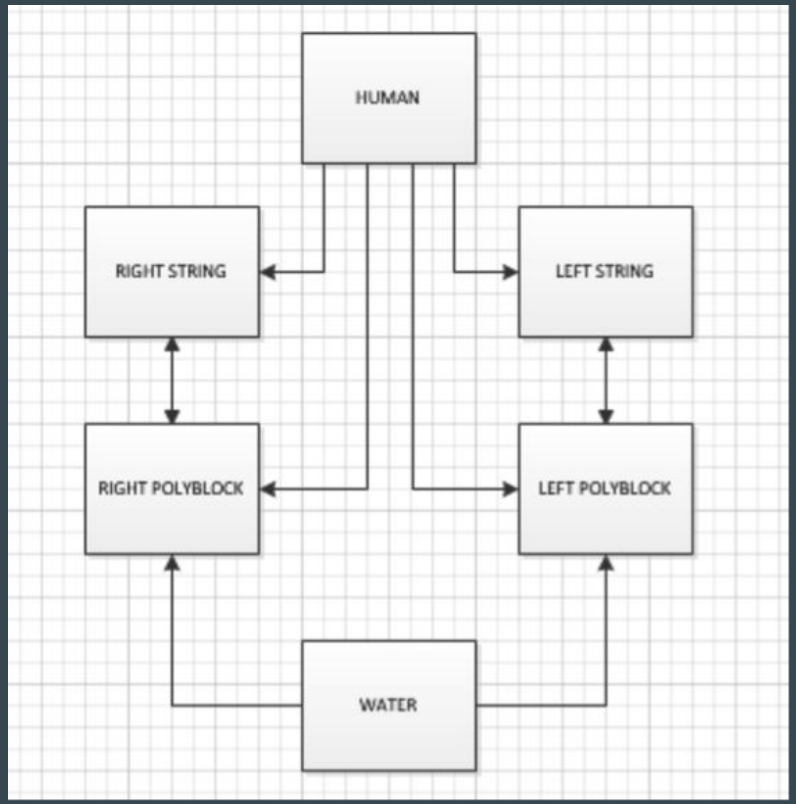
Table 2. Buoyancy Calculations

Buoyancy Calculations

Width	Length	Height	Volume (ft^3)	Volume (m^3)	Weight (N)	Buoyant Force	Total Weight
1	1	0.75	0.75	0.0212	6.19	208.34	889.09
1	1.5	0.75	1.125	0.0319	9.28	312.51	892.18
1	2	0.75	1.5	0.0425	12.38	416.68	895.28
1.5	2	0.75	2.25	0.0637	18.56	625.02	901.46
1.75	2	0.75	2.625	0.0743	21.66	729.19	904.56
2	3	0.75	4.5	0.1274	37.13	1250.04	920.03
2	4	0.75	6	0.1699	49.50	1666.71	932.40

Constants	
Load (N)	882.9
Gravity (m/s^2)	9.81
Water Density (kg/m^3)	1000
Polyblock Density (kg/m3)	29.7

Fig 3. System Block Diagram & Free Body Diagram



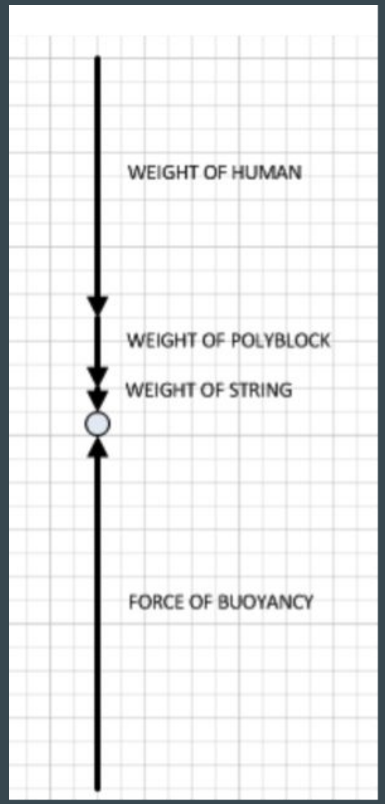


Table 3. Cost Analysis

Bill of Materials			
Description of component	**Quantity**	**Unit Cost**	**Extended Cost**
Polysterene Block	2	$32	$64
Rope	2	$1	$2
Gorilla Glue	1	$3	$3
Duct Tape	1	$3	$3
		Total:	$72

Prototype/ Model

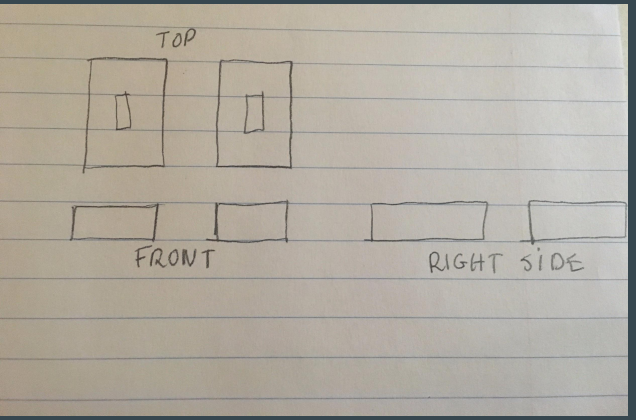


Fig 4. Multi views of device

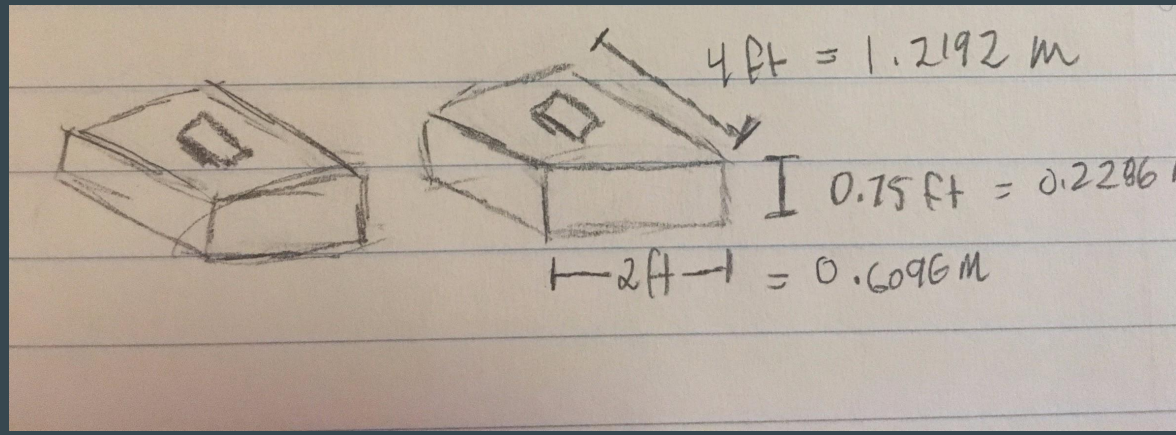


Fig 5. 3D sketch with dimensions

Fig 6. front view of rope

Fig 7. back view of rope

Rope Design

Summary and Conclusions

- We spent too much money on the device.
- Successfully walked on water.

Gantt Chart

3.0 specifications	3.3 discover appropriate price range	2	5-Feb	7-Feb
	3.4 consider hydrodynamics & boyancy	2	5-Feb	7-Feb
	3.5 determine appropriate minimum/maximum weight capacity	2	5-Feb	7-Feb
	4.1 organize information	3	8-Feb	14-Feb
	4.2 generate concepts/ideas	2	8-Feb	14-Feb
	4.3 sketch prototypes/proof of concepts	3	8-Feb	14-Feb
4.0 brainstorm ideas	4.4 create list materials	3	8-Feb	14-Feb
	4.5 assess costs of different materials	3	8-Feb	14-Feb
	4.6 brainstorm which materials will be best in water	3	8-Feb	14-Feb
	4.7 brainstorm which materials will be recyclable	3	8-Feb	14-Feb
	5.1 Assess performance vs. cost effectiveness & select best option	4	15-Feb	17-Feb
	5.2 analyze materials for best boyancy	4	15-Feb	17-Feb
	5.3 analyze ergonomics	4	15-Feb	17-Feb
	5.4 assess manufacturabilty	4	15-Feb	17-Feb
5.0 evaluate ideas	5.5 Determine how to recycle materials after the life of product	3	15-Feb	18-Feb
	6.1 Select best material based on cost/boyancy/durability	4	18-Feb	19-Feb
	6.2 Perform mathematical analysis	4	18-Feb	19-Feb
	6.3 Generate peliminary sketch of design	4	18-Feb	19-Feb
	6.4 design in CAD	4	19-Feb	20-Feb
	6.5 Generate List of Materials	4	19-Feb	20-Feb
6.0 analyisis	6.6 perform final cost of design	4	20-Feb	21-Feb
	6.7 create construction plan	4	20-Feb	21-Feb
	7.1 procure materials needed	5	22-Feb	22-Feb
	7.2 find a location to construct the device	5	22-Feb	22-Feb
	7.3 construct design	5	23-Feb	25-Feb
	7.4 perform preliminary test of device	5	25-Feb	27-Feb
	7.5 evaluate performance and debug device	5	25-Feb	27-Feb
	7.6 finalize design	5	27-Feb	29-Feb