Project Deliverable C: **Conceptual Design**

Carolina Ortiz, Jackson King, Heidi Gordon, Stephen Marchewka

1. Based on our problem statement and our meeting with David, we have come up with some criteria and a list of product concepts that we will be including in our design.

a. As small as possible (to fit in trunk of car)
b. Adjustable
c. Steering device (Attendant steering)
d. “Cool” Factor
e. Cup Holder
f. Stride Control
g. “Ice Wheels” (for movement in more than one direction)
h. Lightweight and durable material
i. Easily usable for people with disabilities.
j. Arrest the fall

In addition to our needs, optional product concepts include

i. Adjustable width
ii. Passenger (Liam) steering
iii. Hooks for skates
iv. Brake
v. Temporary wheels that are able to travel on land
vi. Adjustable handlebar
vii. Forward and back adjustable seat feature

2. In order to incorporate all the product concepts we’ve come up with, we need to have a plan on how we will design and build all of these concepts

A. In able to make the device as light as possible, we will be dimensioning it as small as possible.
B. An adjustable seat will be attached on top of a pole allowing the seat to move up and down to adjust to the skaters need. We can use either telescoping poles or attachable poles. The telescoping pole could have 4 holes equally spaced around at every height that will allow the skater to sit in four different directions. The height also has to be adjustable to accommodate height differences when Liam grows.
C. The attendant will be able to steer the device using the blades of a hockey stick. The blades are easy to hold onto and contribute towards the cool factor.
D. Liam requests there to be a cool factor on his skating aid, so during our first meeting with David we asked about things Liam likes and we plan to include those in our design.

Some solutions for the cool factor include things like flags, colourful head and tail lights, hockey team logos and other things Liam will like.

E. Liam also requests that we include a cup holder in our design. Depending on our design we will either be attaching the holder onto the side, or making it built in.
F. Obviously while learning how to skate, kids are still not completely stable and often slip very frequently. To stop their legs from spreading too far, we will be putting two leg guards on either side of the support. Our idea is to attach four guards onto hinges that will be folded down from the top 4 sides of the support.
G. David wants a product that is easy to move. David had included wheels in his prototype but there was a fair bit of friction between the wheels and the floor. If we change the wheels to wheels with minimal friction then it will move a lot easier. This will be useful on the ice and when transporting the product. Our idea is to use semi spheres that will follow the front runners of the support.
H. Lightweight and durable material: David's prototype was made out of wood which is fairly heavy if you use enough of it. David would like a product that will last, and is light enough for his wife to be able to put it in the car with ease. Some materials to consider are aluminium, titanium and plastic (probably delrin).
I. In able to make this device easily usable for kids with disabilities, our handles must be rounded so that they can easily grip and grab a hold of the supports. A skate guard is required for some people with disabilities to ensure that they don't spread their legs too far apart. A keel can also be used to ensure that they don't cross their legs or have them too close together.
J. Options for arresting the fall are to have a seat to catch the user if they fall. A tube with padding that stretches from the front to the back of the device. A harness could also be used to catch the user either from an overhead support or from a support at hip height.

3. Evaluating our solutions involves making charts and giving them ratings.

(5 is the best)

Cool Factor

Criteria	Weight	Lights	Flags	Cup Holder	Hockey Sticks	Hockey Team Logo
Price	60%	3	2	4	1	5
Lightweight	20%	3	2	4	1	5
Safety	10%	4	N/A	N/A	5	N/A
Accessibility	10%	N/A	N/A	N/A	5	N/A

Materials

Criteria	Weight	Wood	Aluminum	Steel	Titanium	Plastic
Price	50%	5	4	2	1	3
Strength	25%	2/3	1	4	5	2/3
Lightweight	25%	2	5	1	4	3

Past Designs

Criteria	Weight	David's Ice Cube	1991 Design (Seat harness) (U.S. Patent No. 5033734.)	2014 Design (Rocking horse) (U.S. Patent No. 2014/0141940 A1)	2003 Design (Over head Support) (U.S. Patent No. 6537077 B1)
Transportability	25%	3	2	4	1
Safety	50%	3	2	1	4
Price	10%	2	4	3	1
Accessibility	15%	3	1	4	2

4. Choosing a promising solution based on our criteria charts

1.) Materials:

Different sections of our design will use different materials based the criteria needed for that specific part. For example for parts that need to support a lot of weight, we will be using materials such as titanium and steel.

First of all the overall structure of the device needs to be very strong, but also considerably light while staying within a decent price point. Therefore according to our chart titanium would be the most ideal material to use for our structure because it is the strongest material, and also considerably light. However it is also quite costly so this adds to the reason why we need to assure our design is small as possible.

Supporting bars such as handhelds and also the stride guard don't need to support so much weight, but instead need to be very light. Also in regards to price, there is a possibility that we are going to use old hockey sticks donated from clubs or stores as the supports, this will add to our cool factor, and help us out with our restraining budget. Therefore composite will be used for the supports.

Our idea for the "Ice wheels" is to use semi-spheres on the bottom that will allow the device to glide across the ice. We will need a material that has little friction with the ice, and is also considerably light. Therefore plastic is the ideal material.

2.) Design:

We are going to use the cubic design. It would be easy to transport in the back of a car as long as we make it foldable with the front and back sides on hinges. We can also attach small wheels for it to be wheeled to and from the house, car and rink much like a hockey bag. Although the overhead harness has the highest ranking for safety, our client would not be able to transport it easily and it is expensive to manufacture. The seat of the ice cube will be successful to arrest the fall and easy for Liam and other people with disabilities to use. Although the 2014 design is the most accessible for people with disabilities, there's not as much support to keep the user from falling while trying to skate with it.

3.) Cool Factor:

To make our device cool, we'll be using things like flags, head and tail lights, laser cut hockey team logos, cup holders, and hockey sticks to make our design look cool. We need to make sure that Liam thnks the things we are using are cool.

4.) Adjustability

We will use telescoping pin joint poles to make the device adjustable, that way the adjusting will be quick and easy, and our clients won't be required to carry more pole parts with them to the rink.

5.) Explanation of Design

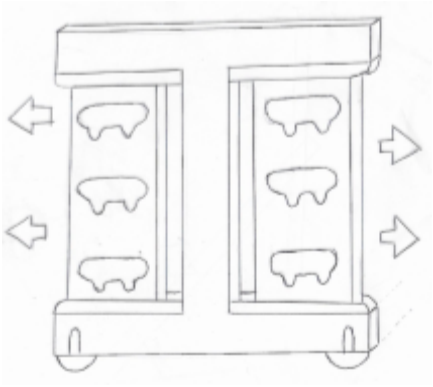
Our design is in the shape of a cube with a nearly identical front and back. The main structure of the design including the front, back, keel and seat support will be made of steel for strength.

There will be movable handles from the front to the back of the aid allowing for the height and distance to be adjusted according to the user's needs. The handles will be made of hockey sticks with a stopper at one end and the blade of the stick will be at the back of the device for the attendant to use as handles.

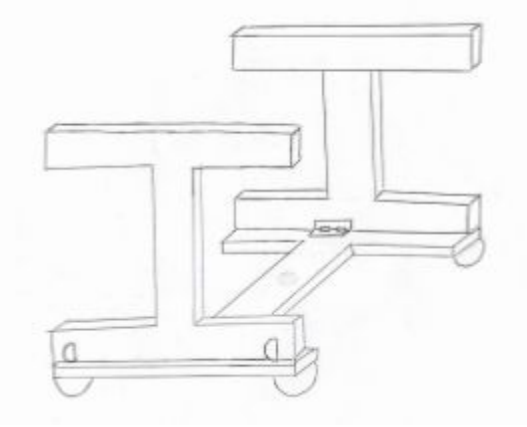
A pole with a seat will be able to screw into the centre of the keel (tapped) and the height of where the back folds in will be flush with the height of the keel. The front will be offset with respect to the back so that they can fold in and lie flat (hinged). The pole will be telescopic for the seat height to be adjustable. The seat will be shaped similar to the shape of a skateboard (an oval with upright edges).

Semi spheres will be used as wheels on the ice to be able to move in all directions and they will be on the sides for easy transportation off of the ice.

6.) Sketches of our group concept:

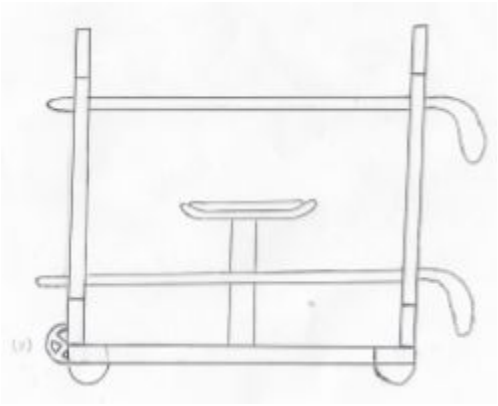


Front View



Orthographic view

Side View



7.) **Core Functionality**

The main focus of our design is to assure that Liam and other kids using the device will not get hurt while skating. Therefore our design will arrest their fall before they hit the ice and prevent any kinds of injuries.Our target specs explain that we want a small, lightweight design, but also a strong material that will be used to construct our design. We believe that our design has many beneficial factors that will satisfy our customers wants. This will take a long time to plan and actually build, therefore we must stick to our agenda and plan that we have created to get this project done on time.

References

Jalbert, T.J. (1991). United States Patent No. 5033734. New Milford, Conn.

Johnson, M.E. (2003). United States Patent No. 6537077 B1. Hanover, MA.

Simon, E. (2014). United States Patent No. 2014/0141940 A1. Warren, CA.