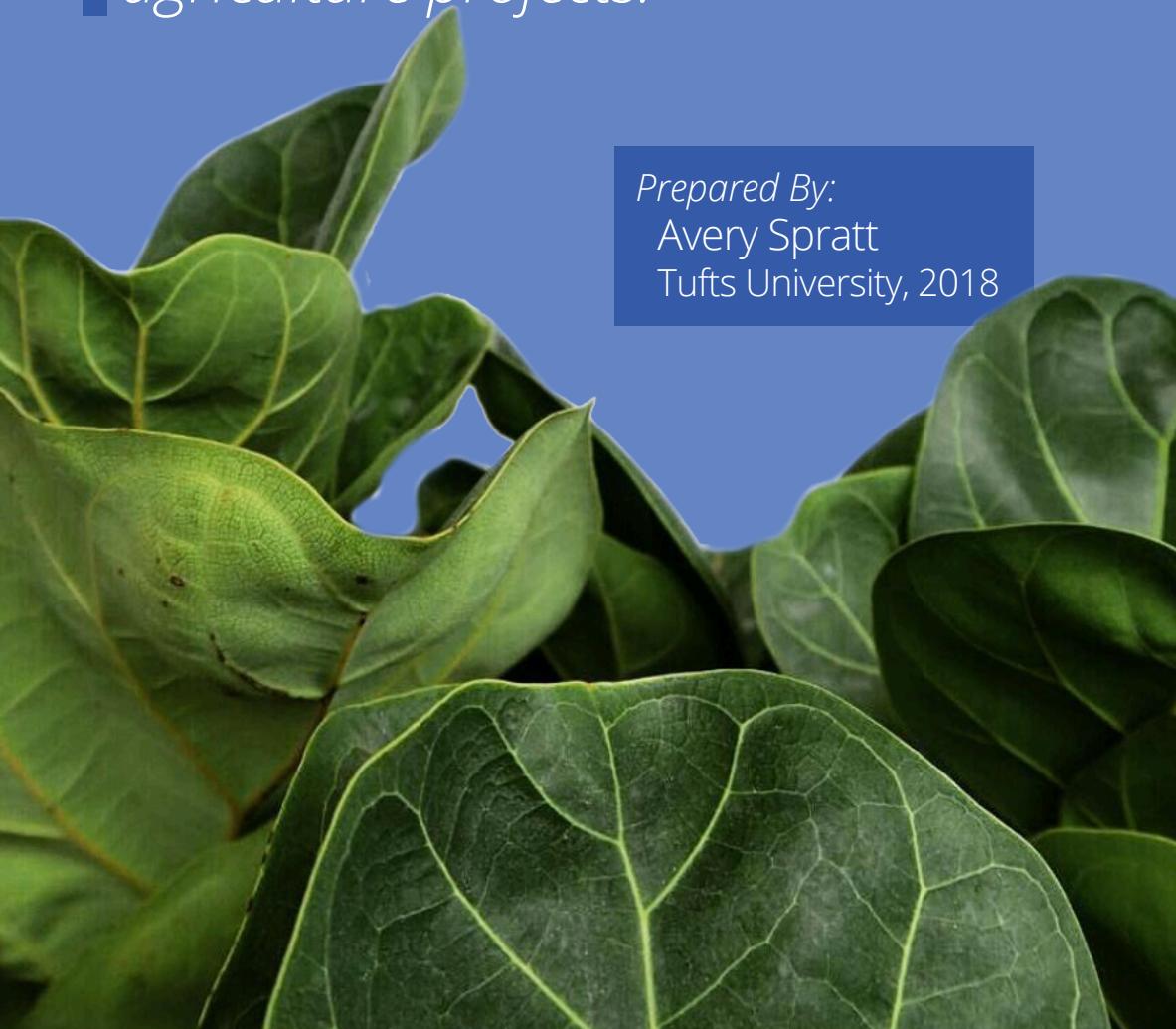
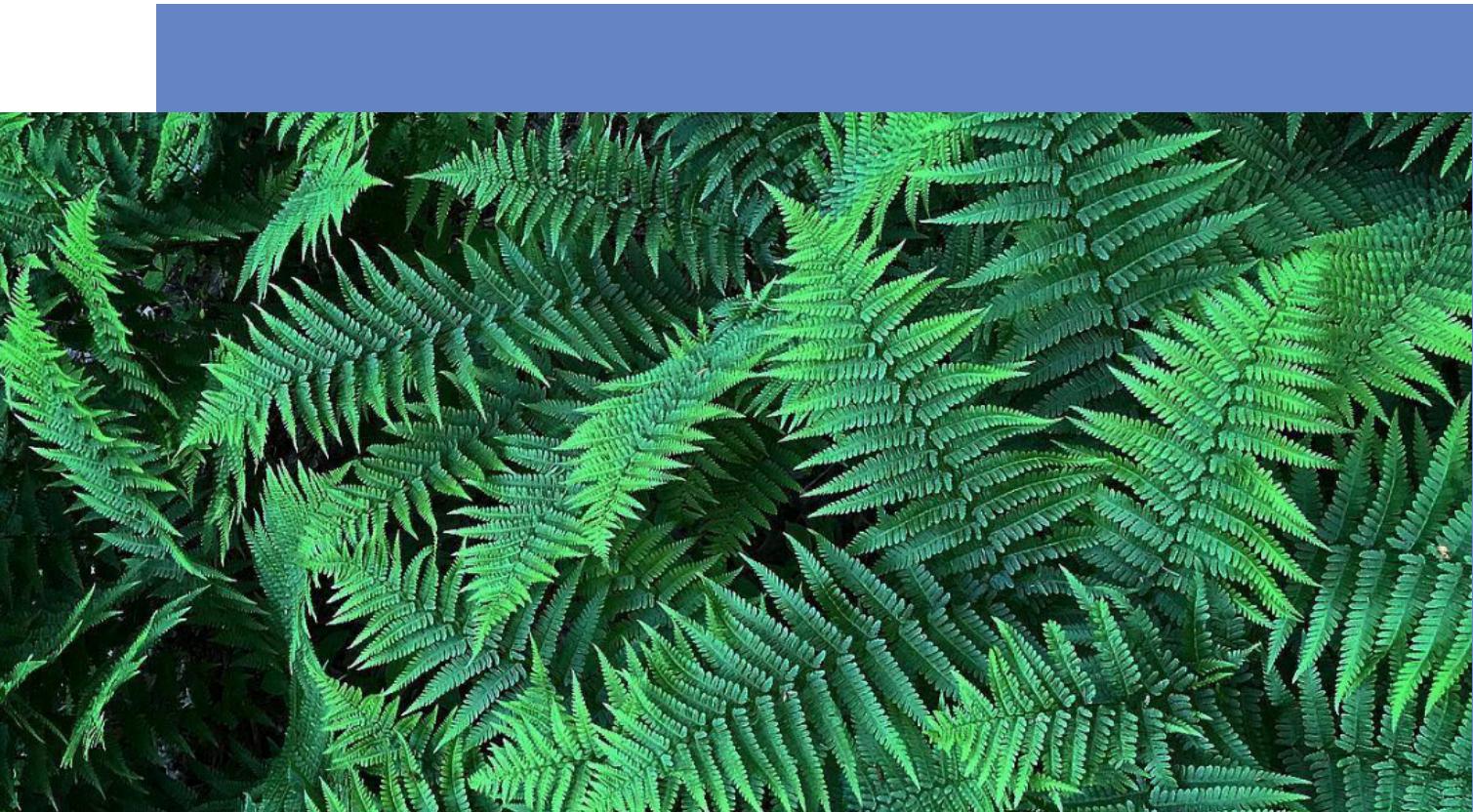


# CAPSTONE PROJECT PROPOSAL

*Laying the groundwork for STEM education through hands-on urban agriculture projects.*

*Prepared By:*  
Avery Spratt  
Tufts University, 2018





**THIS PROJECT AIMS TO DEVELOP A  
PRODUCT THAT PRODUCTIVELY UTILIZES  
TECHNOLOGY WITHIN CLASSROOMS TO  
ENHANCE STEM EDUCATION FOR  
ELEMENTARY SCHOOL STUDENTS**

The research outlining the beneficial presence of plants in our daily life, especially in educational settings, is undeniable. Embracing these principals, this project strives to develop a planter+app system to compliment STEM education with hands-on, plant-based projects tailored for elementary school students.

This proposal outlines predicted scope and goals of the project, project schedule, and research strategies throughout the course of development.

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# INTRODUCTION

Through this project, I will create a product that introduces children to sustainable, urban agriculture practices and allows hands-on, personal engagement through the growing process. The final product will consist of a combination of a small-scale, indoor gardening kit and a connected app that allows children to track the progress of their plant from planting the first seed to watching their first plant bloom. Tracking data on light-levels, amounts of water, air temperature, etc. will give children an introduction not only to the science of agriculture, but also a framework to understanding big data. The app itself will present visualizations of the collected data, as well as collecting user-input feedback, keeping children engaged and invested throughout the growing process. Ideal for classroom settings, the app will additionally allow students to compare their progress to that of their peers and by answering questions like "Who's plant is the biggest?" and "Which plant grew the fastest?" users will be introduced to basic statistics of mean, maximums, minimums, variance, range, etc. relating to personally relevant data. Growing a plant from a seed is a long process and, to children especially, can begin to feel like "watching paint dry". By giving users authority in creating the ideal environment for their plant and the opportunity to track various elements during the process, the final product will maintain a level of active participation necessary to hold the user's interest, whether it is used as a educational tool within the classroom or a personal project at home.

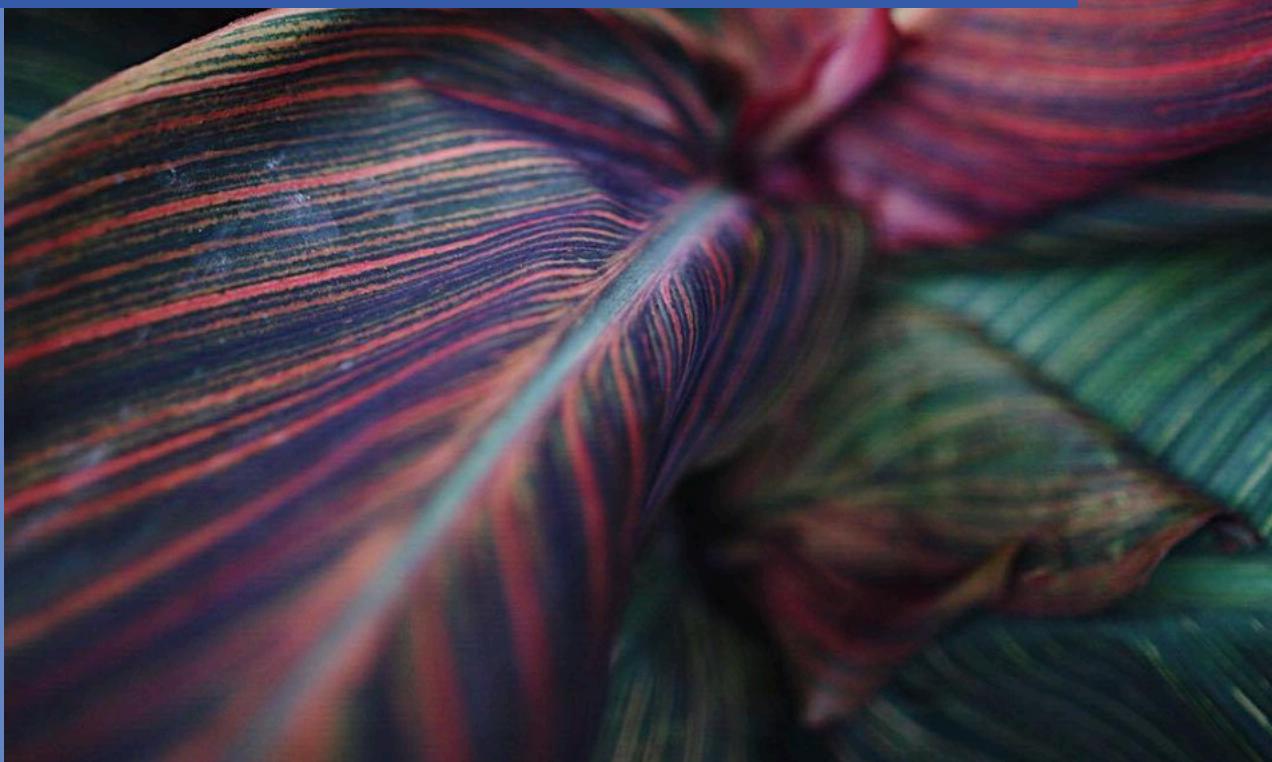


## WHY PLANTS?

For the past two summers, I have coordinated an event at Tufts for my summer internship project, *Campus Cactus*. These events are designed to welcome incoming college freshmen to campus with the best roommate you can ask for- a cactus! *Campus Cactus* was developed in response to extensive research on the benefits of house plants. Numerous studies have highlighted how the presence of plants in work and living spaces enhance productivity, increase motivation and memory retention, reduce stress, and improve overall mood. I strongly believe that these benefits of plants makes them ideal elements of hands-on education.

# INSPIRATION

This project is part of the Tufts University senior capstone class in Human Factors Product Design. All projects completed during this year-long capstone are inspired by the theme "The Classroom of the Future". During the brainstorming classes to kick off the year, groups focusing on Virtual Reality, Smart Boards, and Telepresence began to form. Many students gravitated toward cutting-edge technologies to take classrooms to new realms, and I felt many of my classmates were boarding a rocket ship to *the future*. While I am as excited about the potential of advancements like VR and Smart Boards as the next designer, I found myself plagued by a previous class. Just one year ago, I spent an entire semester in my Experimental Psychology class researching the question "Which is mightier- the pen or the computer?" inspired by the findings of Mueller & Oppenheimer. Studies surrounding the disadvantages of technology in classroom settings cluttered my mind when trying to brainstorm the next technology for the future of education. However, thinking back to my Experimental Psychology class also reminded me of my frustrations with that course. We spent an entire semester justifying a resistance to technological advancements that had already become staples of so many educational settings. It felt counter-productive to identify a problem with such an integral part of modern life with no intention of identifying a solution. In this capstone project, I saw an opportunity to develop a solution and answer my lingering question - how can classrooms utilize technology as a tool to enhance learning? With the starting motivation to productively utilize technology as a way to promote engaging, hands-on learning the planter and app system blossomed. Consider it my personal rocket ship to the classroom of the (*near*) future.



# ABOUT ME...



*Hi! My name is Avery Spratt.*  
I am a senior at Tufts University  
majoring in Engineering Psychology,  
paired with minors in Computer  
Science and Studio Art.

I believe the point of intersection between my three concentrations exists in anything based in a human-centered approach. I strive to let my research drive the development of creative design solutions that promote accessibility and enjoyable interaction for all users. I am eager to apply these practices to design a hands-on system for *the classroom of the future.*





# RESUME

## WORK EXPERIENCE

### EDUCATION

Tufts University,  
Medford, MA

Bachelors of Science,  
Engineering Psychology

Expected: May 2018

Minors: Computer  
Science, Studio Art

Ponte Vedra High School,  
Ponte Vedra, FL

Graduated May 2014, 4.4

National Honor Society,  
Science National Honor  
Society, Mu Alpha Theta,  
National English Honor  
Society

### SKILLS

#### Technical Skills

Adobe Suite  
Balsamiq  
Sketch  
Marvel  
JIRA & Confluence  
AutoCAD  
Inventor  
SPSS

#### Languages

C  
C++  
HTML/CSS  
Javascript  
Bootstrap  
Spanish

#### Tufts Music Department - Publicity Assistant

February 2015- present

- + Design posters, compile press releases, and head publicity for concerts put on by the music department
- + Respond to student, faculty, and visitor inquiries.

#### SQRRL - UX Intern

Summer 2017

- + Collaborated with product team on concept development for future directions, specifically in data visualizations and user interaction.
- + Designed solutions to UX problems for the KOLA product release.

#### Loyal Supply Co - Intern and Retail Associate

June 2016 - June 2017

- + Collaborated on design consultations and lead human-centered research collection.
- + Managed sales, returns, and inventory in retail shop
- Co-Founder of Campus Cactus**
- + Responsible for conceiving and establishing project geared toward creating a smooth transition for incoming college students.

## VOLUNTEER EXPERIENCE

#### Tufts Psychology Society

President January 2015 - January 2017

**Webmaster / Historian** October 2014 - January 2015

- + Managed team of 17 executive members in planning club events.
- + Developed and oversaw club website and social media pages.

#### Tufts University Admissions - Tour Guide

January 2016- October 2017

- + Volunteered with Tufts Admissions to represent the school to perspective students and families.

#### Jumbocode - UX/UI lead

Fall 2017

- + Collaborated in a group of 13 undergraduate students of ranging skill levels to develop a map-based visualization of news stories for local non-profit, Boston Institute of Nonprofit Journalism

# USER GROUP

The target user group for this project is elementary school students. Specifically, 4th and 5th graders, or children between the ages of 8 and 11.

\*Side Note: Although research will be committed to optimizing the product for use as an educational tool for young students, users of other ages or educational histories will not be discouraged from using the product. Because, after all, we all have a lot to gain from hands-on, plant-based projects.



## THEMES

1

*Current Curriculum*  
Understanding how topics of agriculture, environmental science, and general math are currently presented in elementary classrooms will be vital to creating a product that complements such curriculum.

2

*Technology Use*  
Research into how children interact with technology, especially app based products will help give insight into creating an engaging and accessible app.

3

*Valuable Metrics*  
When considering metrics that could be integrated into or tracked by the system, the possibilities seem endless. Research into what metrics may be most valuable and engaging to students will be necessary to create a product that is not overly complicated.

# DESIGN REQUIREMENTS

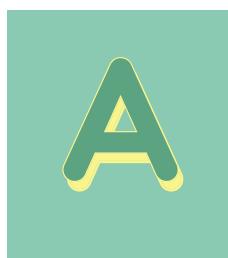
*Develop a planter and app system that ...*

1. Promotes active, hands-on engagement throughout the growing process.
2. Functions as a supplementary educational tool.
3. Introduces users to principals regarding basic environmental science and big data mathematics, including elementary statistics.
2. Tracks metrics that are influential to plant growth.
3. Encourages users to record and track their own plant-related metrics.
4. Utilizes simple data visualizations to display metrics
5. Allows users to compare multiple plant systems
6. Physically does not occupy a lot of space, allowing for sustainable and feasible indoor use in urban settings.

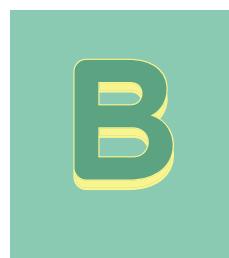
# PROJECT SCHEDULE



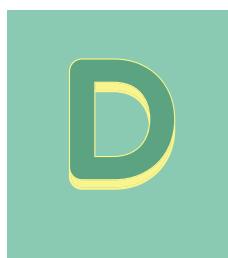
# DELIVERABLES



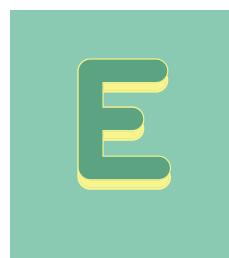
*INITIAL RESEARCH REPORT*  
(December 8, 2017)



*INTERIM REPORT*  
(December 22, 2017)



*SECONDARY USABILITY ASSESSMENT*  
(April 6, 2018)



*FINAL SPECIFICATION*  
(April 20, 2018)

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JAN 8, FEB 23 MAR 2 MAR 16 MAR 30 APR 6 APR 13 APR 27 MAY 7  
2018



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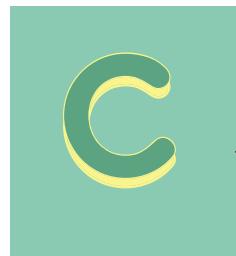
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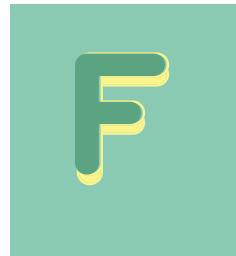


IM REPORT  
(nber 22, 2017)



INITIAL USABILITY  
ASSESSMENT  
(March 2, 2018)

DESIGN  
FICATION  
(7, 2018)



FINAL REPORT &  
PRESENTATION  
(May 7, 2018)

# DESIGN PROCESS

**1**

## Initial Research

During the initial research phase, a variety of research will be conducted to develop a well-rounded understanding of our target user group and how to best develop a product for their needs. This will consist primarily of surveys, expert reviews and interviews, and competitive analysis. Because this project is dealing with a young and difficult to access user group this initial research phase will depend heavily on experts in early education, environmental education, and STEM education for younger students to represent the needs of our user group. *A report summarizing these findings will be delivered on December 8, 2017.*

**2**

## Concept Development

During concept development, the findings of the initial user research will be used to develop three initial prototypes for the product. These will include concept designs for the physical product, the planter, as well as wireframes for the digital product, the app. Prototyping tools including Adobe Illustrator, Photoshop, and Experience Design; Marvel and Sketch will be used for the development of these prototypes.

*A report detailing these initial concepts and the work leading up to them will be delivered on December 22, 2017.*

**3**

## Initial Usability Assessment

To assess the three initial concepts, usability testing will be conducting on the prototypes created during the previous stage. This initial testing will be based mostly on cognitive walk-throughs, expert reviews, focus groups, and demo+reactions. Light usability tests may be conducted, either with experts and extreme users or, ideally, on users from the target user group, depending on access.

*A report summarizing these findings will be delivered on March 2, 2018.*



# 4

## Concept Refining

Similarly to the concept development phase, concept refining will depend on the results of the initial usability assessment and research to develop a single prototype. Since it represents the findings of our user research, the refined prototype will likely be some combination of the three initial concepts to best fulfill user needs. This concept's prototype will be more complete than the three initial concepts for more deeper usability testing, but will be created using similar tools.

# 5

## Refined Concept Testing

Using the prototype developed during the previous phase, extensive usability testing will be conducting with participants of our target user population. For a more complete assessment, reviews from experts will also be integrated into this phase of testing.

*A report detailing the refined prototype and summarizing the findings of the secondary usability testing will be delivered on April 6, 2018.*

# 6

## Final Design

A culmination of the findings from all stages of research will be used to further develop the refined prototype to a completed product. This extensive design spec will include workflows for both the physical and digital products, designs for both the planter and app, and instructions for use. This finalized design will be created with the tools used for concept development as well as any other tools (ie CAD, Framework, Angular, etc.) necessary for developing a finalized design.

*A report with the finalized design specifications will be delivered on April 27, 2018.*

# 7

## Final Report & Presentation

A final report will be created summarizing the entire design process.

*This report will be presented on May 7, 2018.*



# RESEARCH INSTRUMENTS

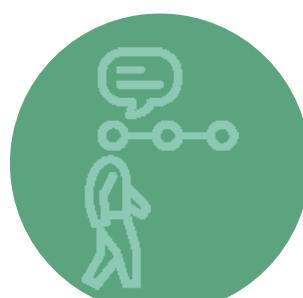
The research is arguably the most vital element of this design process. The research conducted will give insight into what is effective and what is not, relevant history, standard conventions, previous technological innovations, and most importantly, will provide an understanding of the needs and desires of the target users. This project will embrace a human-centered design approach, depending on the feedback of our users to drive the innovation. However, it is important to recognize that with a target user group of late-elementary school aged children, access to users may be limited, although not impossible. To remedy this slight limitation, some of the research may lean heavily on experts and people with direct access to our users for their supplemental insight. People with expertise in cognitive development, early STEM and agricultural education, and use of technology with young populations, especially teachers and parents, will be vital to the project research, especially in earlier stages.



**EXPERT INTERVIEWS  
& REVIEWS**



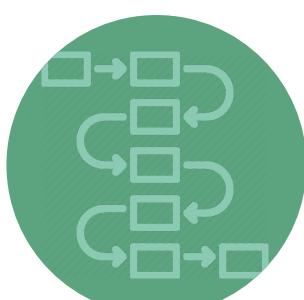
**FOCUS GROUPS**



**DEMOS & COGNITIVE  
WALKTHROUGHS**



**SURVEYS &  
OBSERVATIONS**



**TASK ANALYSIS**



**USABILITY TESTS**



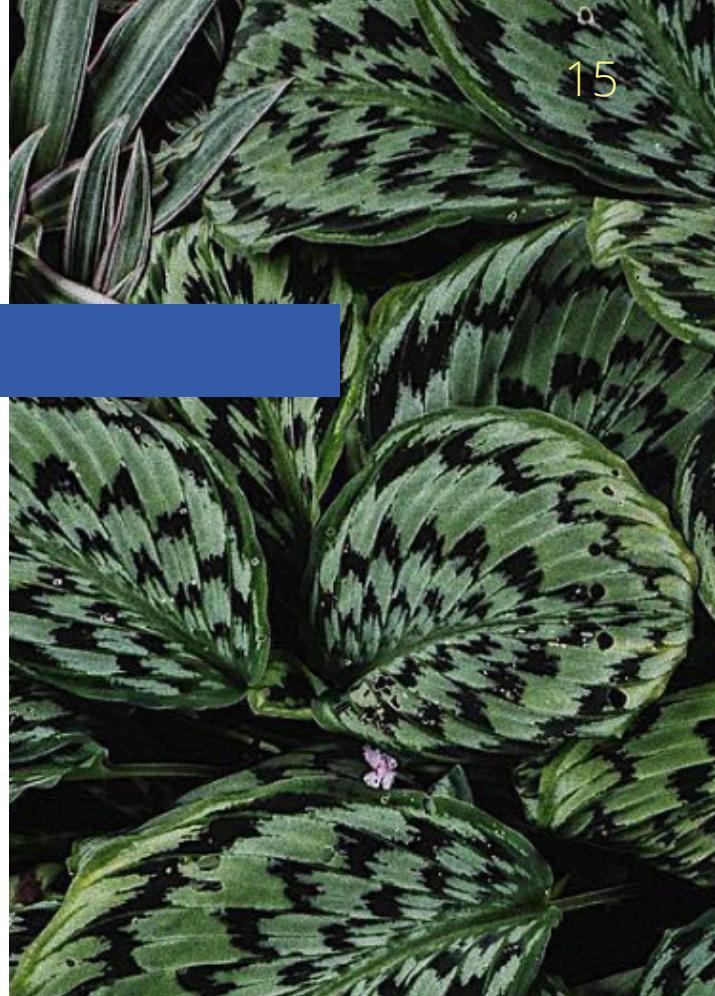
# EXPENSES

## *Product Development*

### Prototyping Materials

Including, but not limited to:  
sensors, planters, lighting,  
starter plants, etc.

*PROJECTED: \$100 - \$250*



## *Research*

### Competitive Analysis

Existing app-based smart  
planters to be used during  
initial stages of research

*PROJECTED: \$50 - \$350*



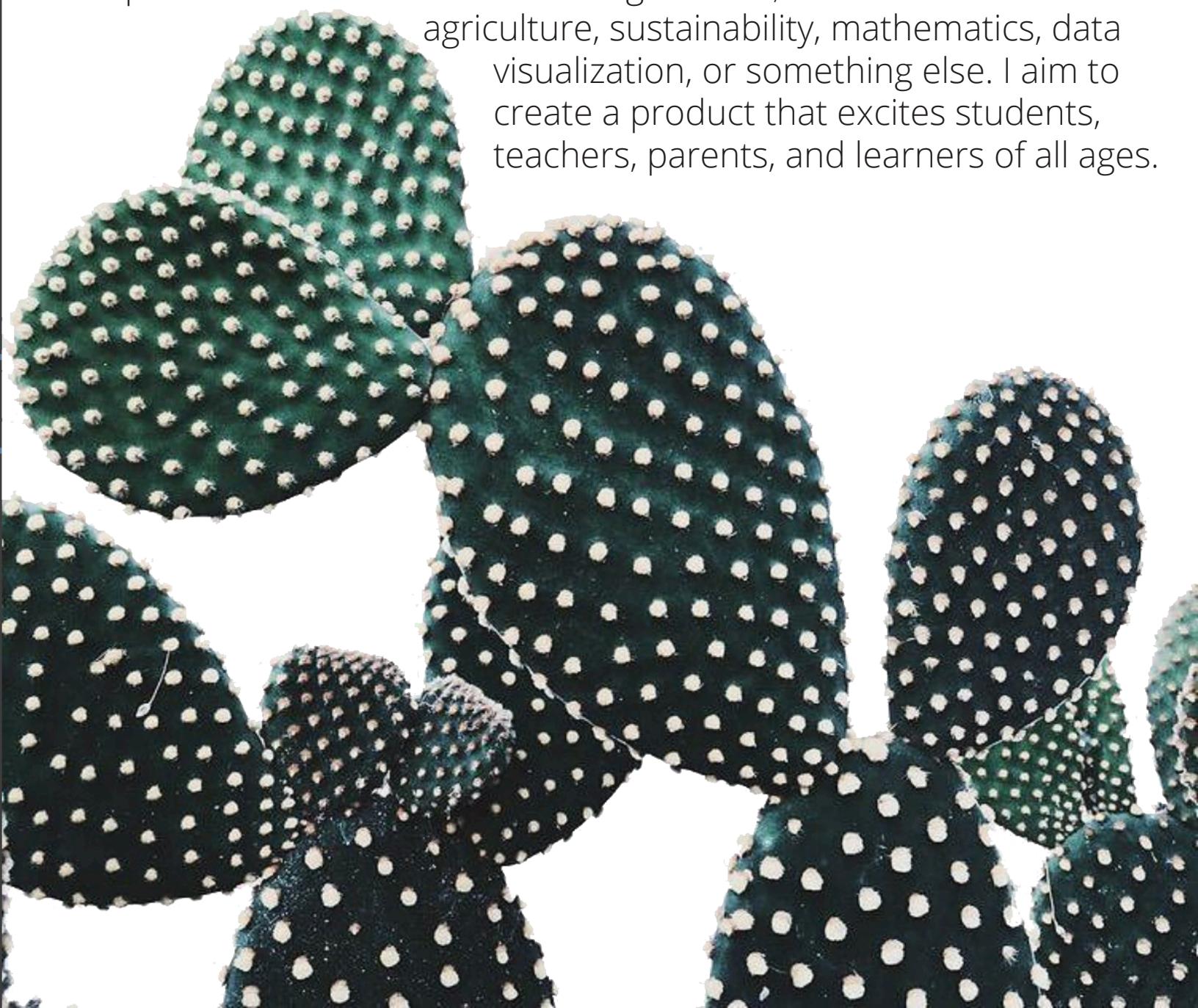
### Participant Incentives

Incentives and rewards for  
participants that elect to  
participate in interviews, surveys,  
focus groups, and other forms  
of user based research

*PROJECTED: \$50*

# CONCLUSION

Through this project, I hope to apply what I have learned during my undergraduate career thus far, both in Human Factors classes and outside of Human Factors, and perhaps pick up a few new skills along the way. I strive to develop a functional product that shines a new light on how technology can be applied in academic settings. For the users, I hope this product brings a new feeling of excitement for learning through innovative methods and lays the groundwork for practices to be carried on throughout life, whether it be in urban agriculture, sustainability, mathematics, data visualization, or something else. I aim to create a product that excites students, teachers, parents, and learners of all ages.



# REFERENCES

Mueller, P. A., & Oppenheimer, D. M. (2014).  
The pen is mightier than the keyboard:  
Advantages of longhand over laptop note taking.  
Psychological Science, 25(6), 1159-1168. Retrieved from  
<http://search.proquest.com.ezproxy.library.tufts.edu/docview/1636814673?accountid=14434>

*All photos retrieved from www.instagram.com/plantsinfocus/*

