Deliverable D

Conceptual Design

GNG1103 Lab Section D02

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1. Introduction

Our team has been given the opportunity to create a modular hydroponic grow wall for our client. In order to generate unique and unbiased ideas for the design of the project we split up independently. We each designed what we thought would be the best functioning, looking, and practical growth wall for the environment, which is an indigenous community center with a focus on child education. When designing our ideas we knew we should keep in consideration child safety and simplicity of use. The grow wall needs to be accessible to all ages and will be used regularly by the community.

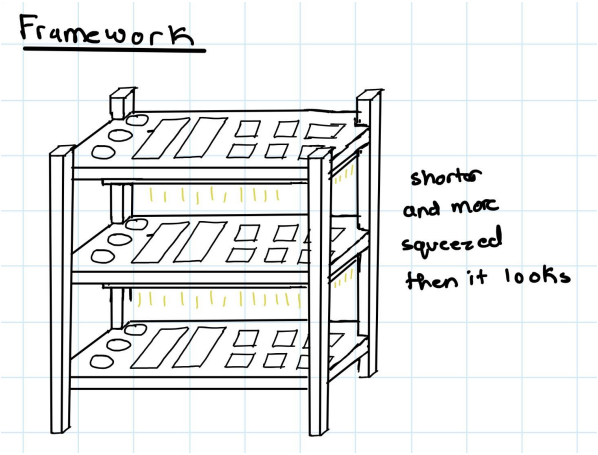
2. Independent Solutions

In order to collect the most ideas for our growth wall design, each group member independently created their own vision.

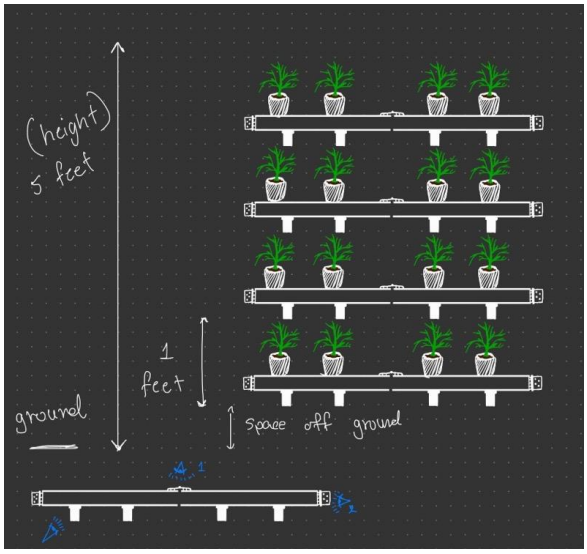
2.1 Generating Ideas

Hydroponic grow walls are used around the world and there are so many different variations. We took inspiration from them but also used our own creative liberty on our solo designs. After comparing our own solutions we will choose the three best, or take parts of each and create a new mixed design. The goal is to present three different innovative product designs to our client.

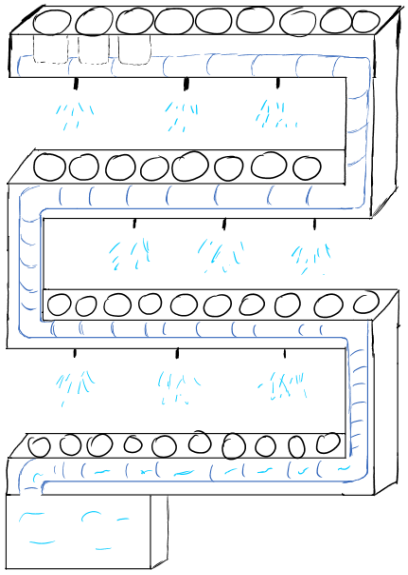
2.2 Sketches of Independent Designs



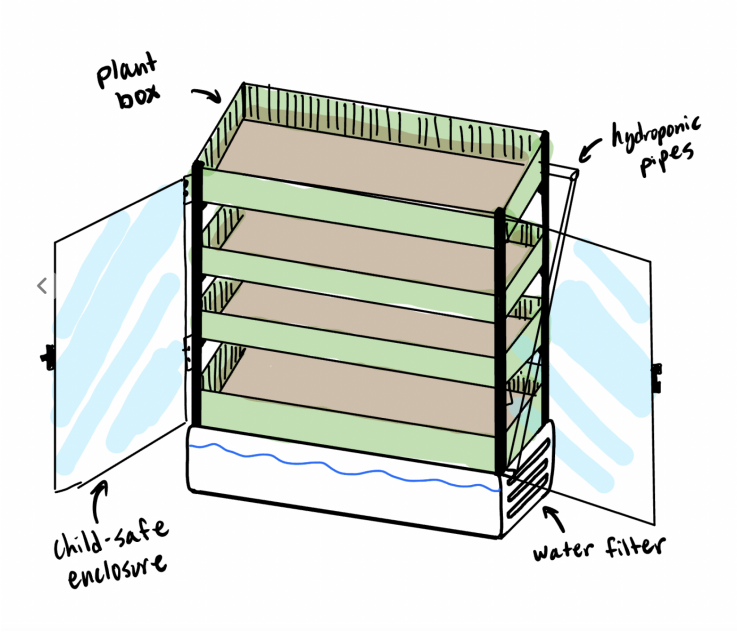
Daniel M.



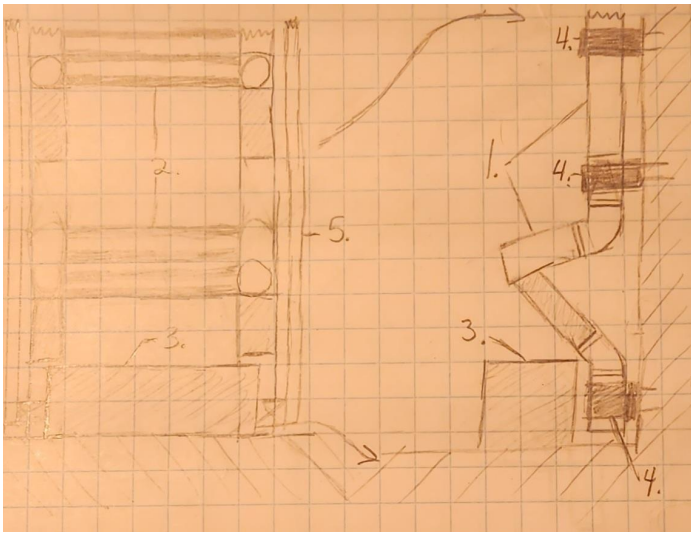
Stavan V.

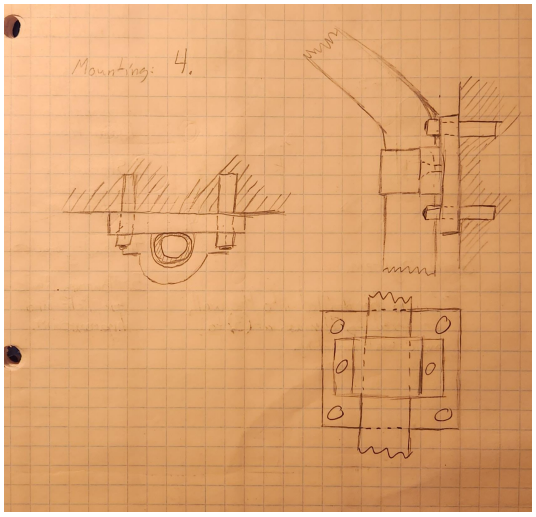


Tomas R.



Sophia C.



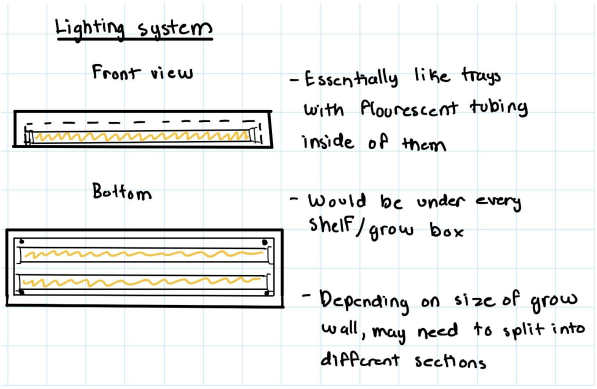


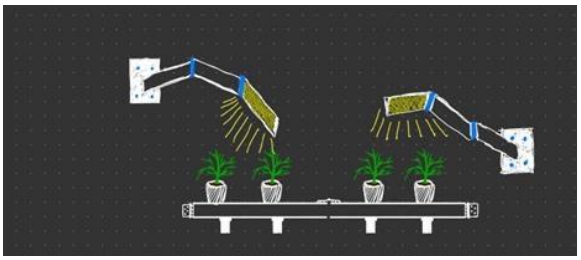
Roeg

2.3 Design Explanations

There were some similarities in most of the designs, but also many differences. In order to create the best and most diverse designs we can make, we took some aspects from each person's designs.

Daniel's design is a modular shelf-like system which is easily accessible and self-sustaining. The frame is solid and can be mounted to the wall. It has fixed shelves that reach 6 feet, with around 2 feet of space between plants or vegetables. Underneath every shelf, there is a fluorescent lighting system which is battery-operated. It is easily transportable and fast to remove if the battery needs to be changed. It is screwed into the corners of the grow box/shelf. The grow boxes inside the shelves are replaceable and can be taken out.





Stavan's solution is a hydroponic shelf system. The shelves are mounted directly onto the wall and look as though it is floating. The shelves are able to fold at the center for easy portability and modularity. He also designed a lighting system that uses extendable, bendy lamps to focus light onto the plants. The lights do need to be mounted onto the wall so it is difficult to move them around when needed.

Tomas created a grow wall that is tubular and is connected to a hydroponic system. It is wall mounted but it is not easily disassembled due to the hydroponic pipes inside. The tubes have small holes for the plants and they have around 1 foot of space between each row. The hydroponic system sprays nutrient-based water to the plants below.

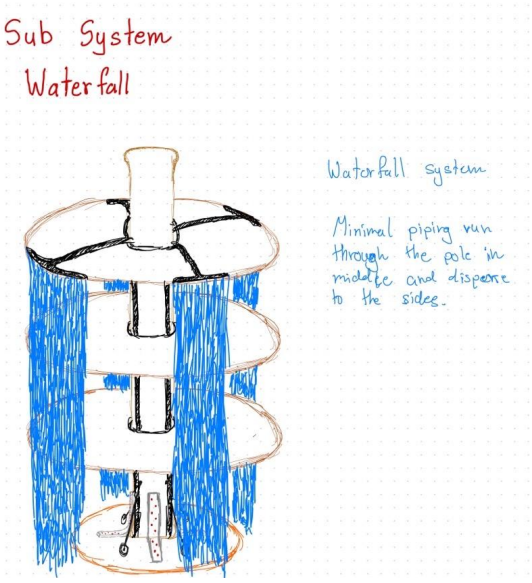
Sophia made a stackable hydroponic grow shelf which can be mounted to the wall to ensure safety. It is modular because the frame and the shelves can be disassembled and reassembled easily. The plant boxes are 1.5 feet deep and have around 2 ft of space between shelves. There will be overhead lighting powered by batteries and plastic doors to enclose the greenhouse.

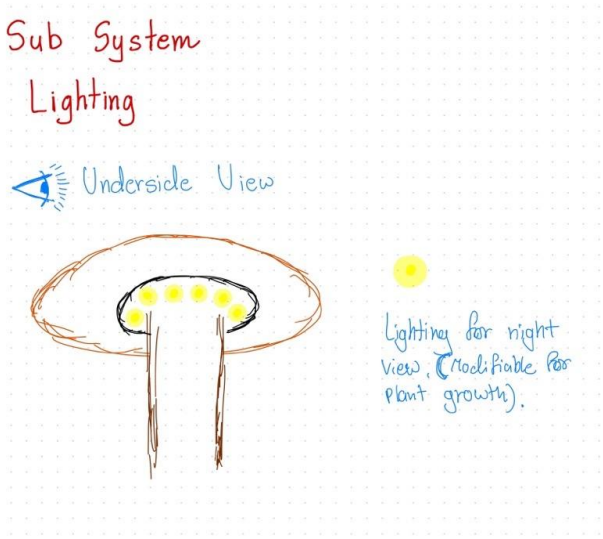
Roeg's design is a wall-mounted system that is comprised of tubes and shelves. The shelves are slanted and connected to the hydroponic system. In order to minimize overwatering, the slanted shelves will drain to the tip of the shelf, and the hydroponic technology will bring the water back to the reservoir. There will be four shelves and a lighting system as well.

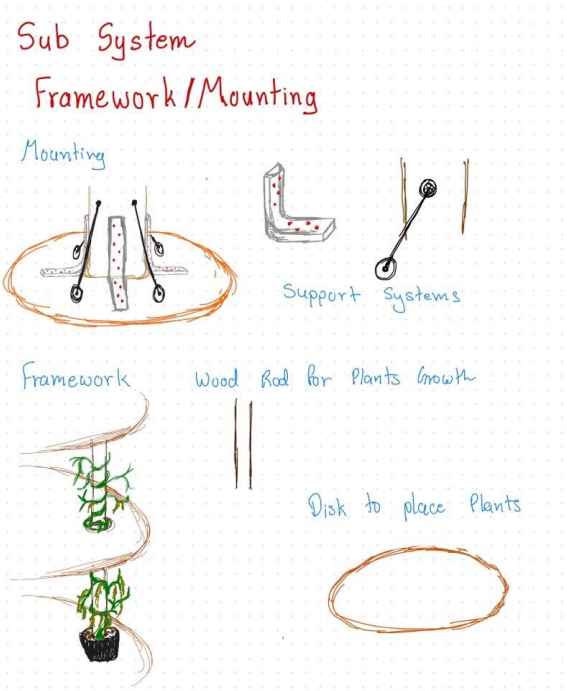
3. Final Designs

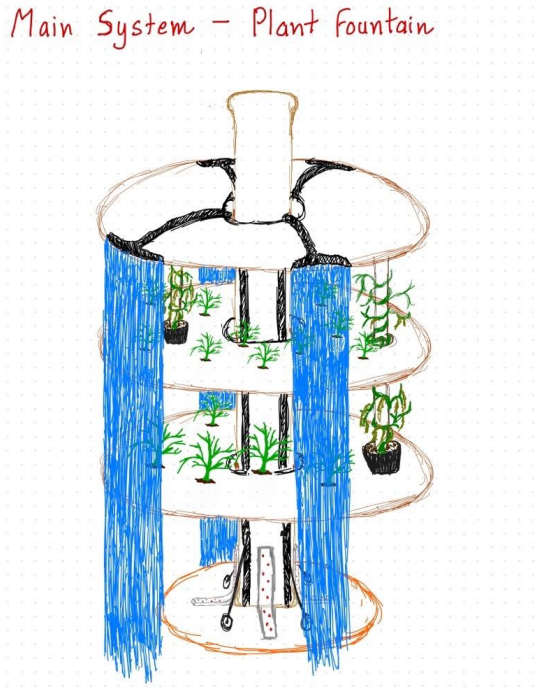
After discussing as a group which systems we preferred we split them into three designs. There are some new designs and also similar designs to the independent solutions. They are shown below.

Design #1 Plant Fountain

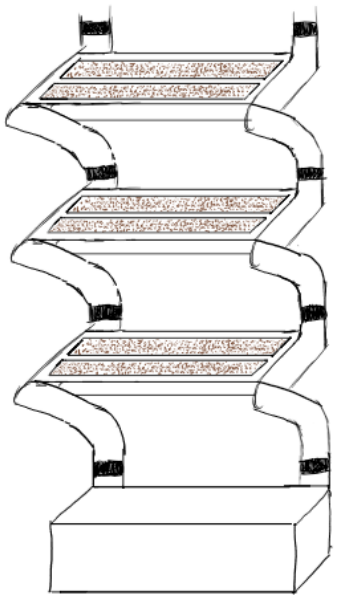


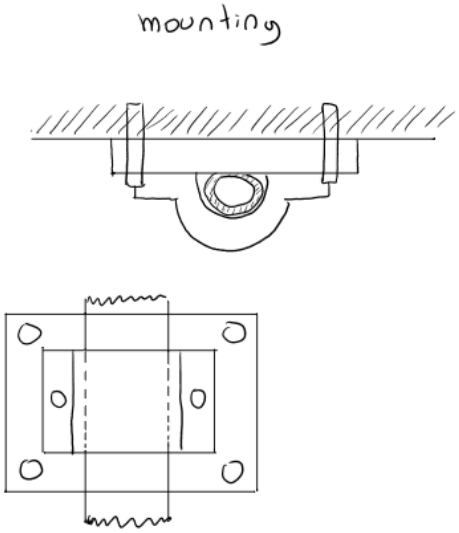


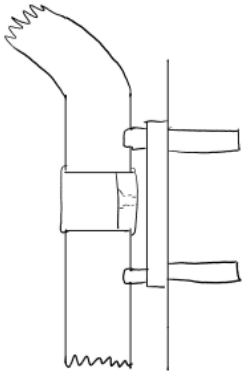


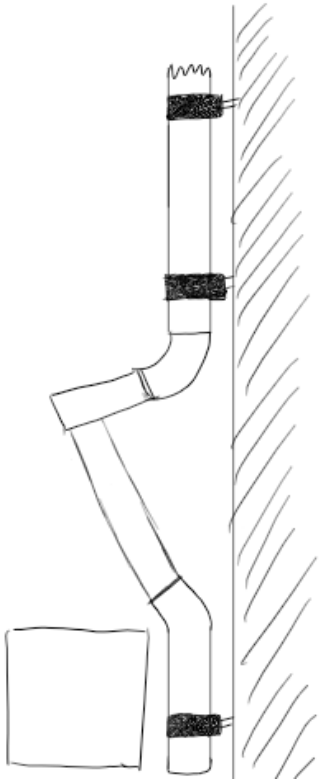


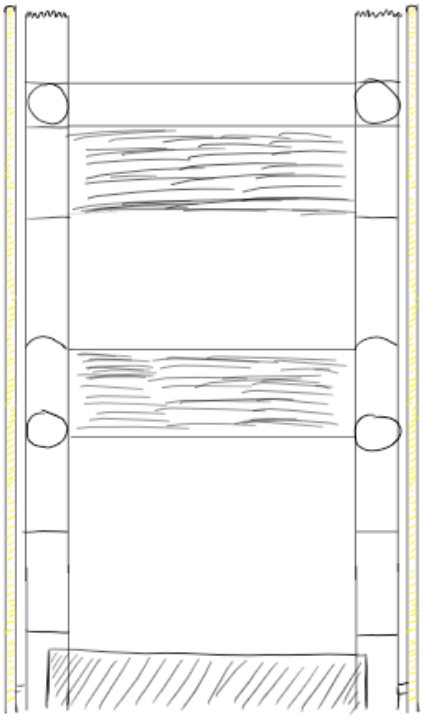
Design #2 Zig-Zag Plant Wall



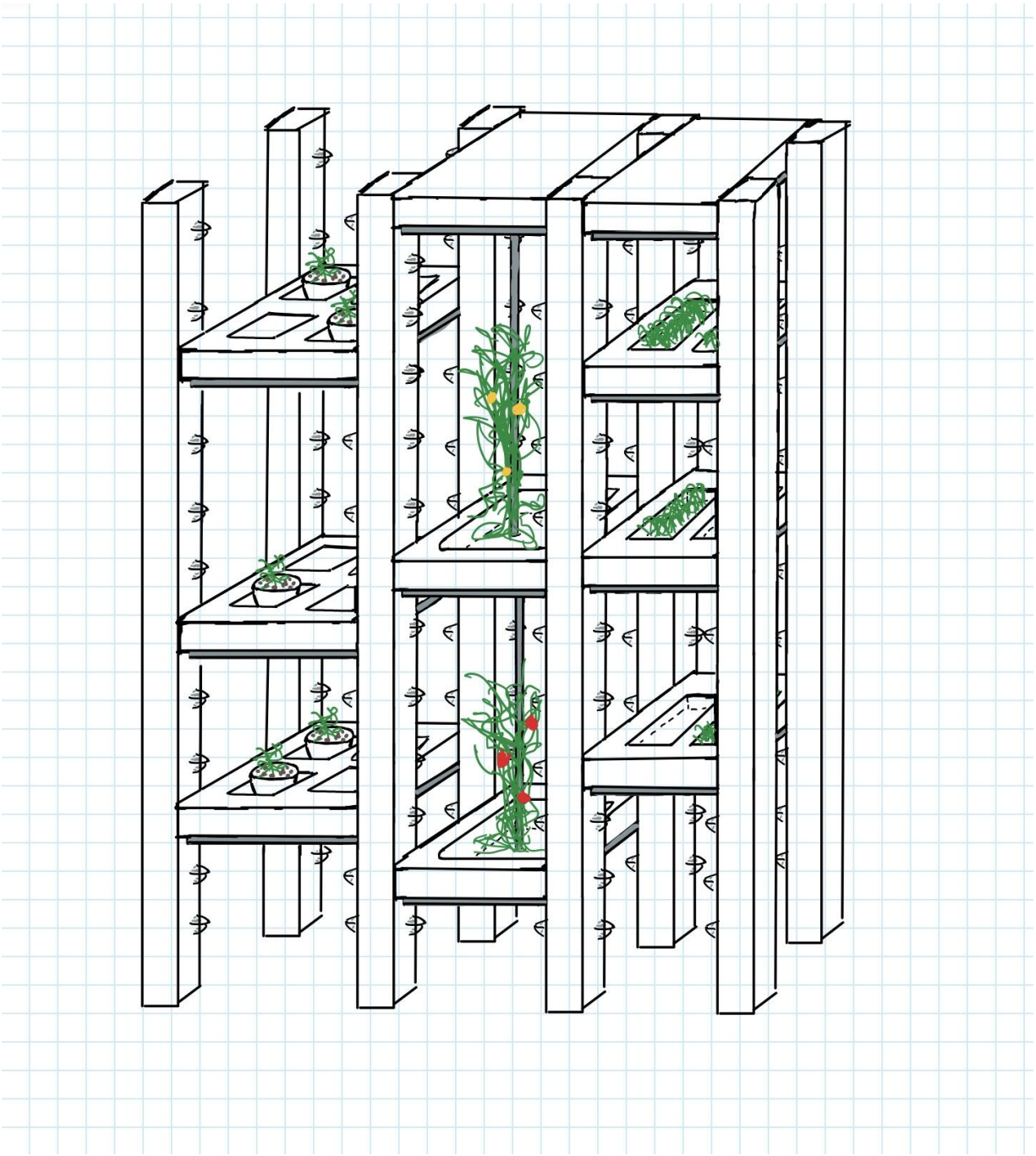








Design #3: Modular Garden Shelf



4. Advantages and Disadvantages

Design #1: Plant Fountain

Pros	Cons
Wall mounting. Extendable height to allow for taller or smaller plants. Adjustable lighting. Foldable for easy transportation. Rotatable for easy access to plants in the back.	The telescopic center may be difficult to adjust for height. Hinges may be a point of failure. May be difficult to fit hydroponics/watering systems. Reduced space due to circular planters rather than squares.

Design #2: Zig-zag plant wall

Pros	Cons
Lightweight: made of low-cost PVC piping. Standard and easy-to-acquire materials to allow easy replacement of damaged components. Possible locations for storage are below the structure. Mounted to the wall. Expandable height and depth to suit needs. 120V socket for lighting.	Piping may be prone to damage if climbed. Shelf-like configuration may be a climbing hazard. Once pipes are cut, the size is unchangeable. Storage on the floor is easy access for youth.

Design #3: Modular Garden Shelf

Pros	Cons
Easy to remove shelves for limitless configurations and modularity. Wall mounting. 6ft tall. Various box sizes for a broad range of plants. Poles are available for vine-like plants.	Battery operated. Only the lower half is covered by artificial lighting. Mounting points may wear over time.

5. Comparing Final Ideas to Design Criteria

Specifications	Design 1	Design 2	Design 3
Name	Plant Fountain	Zig-Zag Plant Wall	Modular Garden Shelf
Cost (CAD)	< 500	< 500	< 500
Size (ft, WxHxD)	8x6x2.5	8x6x2.5	8x6x2.5
Modular	Adjustable shelving. Pieces are transportable once disassembled.	Transportable once disassembled. Adjustable shelves with different sized piping. All pieces can be easily stored	Dissemblable. Fully adjustable shelves. All pieces can be easily stored.
Self Sustaining	Hydroponic Water fountain-like-watering system.	Hydroponic Lights on the side supports. Gravitational watering system	Hydroponic Individual lighting system for each plant tray (adjustable lighting)
Sizable for various produce	Suitable for all plant sizes with smaller roots. As well as plants that need some support.	Suitable for all plant sizes with smaller roots.	Multiple shelves that can be placed at any height therefore carry most plant sizes. Middle support for vines and other bushes that need support.
User-Friendly	Easy access to plants. Self watering system.	Some assembly required with tools. Easy and fast watering. Easy access to plants.	Simple design with latches (easy assembly). Lights with easily operated on and off switches. Easy access to plants.
Safety	Ladder-like design. Only one main support.	Narrow. Wall mounted, can be placed out of reach of small children. Slanted ladder like design.	Ladder like design, Small base

5.1 Method of Presenting Design Solutions to the Client

After curating three different solutions for the indigenous community center, we will present the ideas to our client. In order to make the best possible solution, we will ask many questions to get the most information. We will then take the feedback into consideration and modify our designs. We will ask the client which design they like the best and start the prototyping and testing phase.

6. Conclusion

Creating a solution that exceeds the client's expectations and meets their every need is a daunting task, but with active brainstorming, deducing skills, and adaptability, anything is possible. Our conceptual design helped us make the best three final designs we could. The hydroponic grow wall that we create will be based on what the client chooses as their first pick out of the three final designs. The grow wall needed to be modular, reliable, long-term, safe, accessible, easy to use for all age groups and self-sustaining. We created three designs around those values and we are looking forward to building our first prototype of the design our client picks.