H2O Grow Hydroponics Project

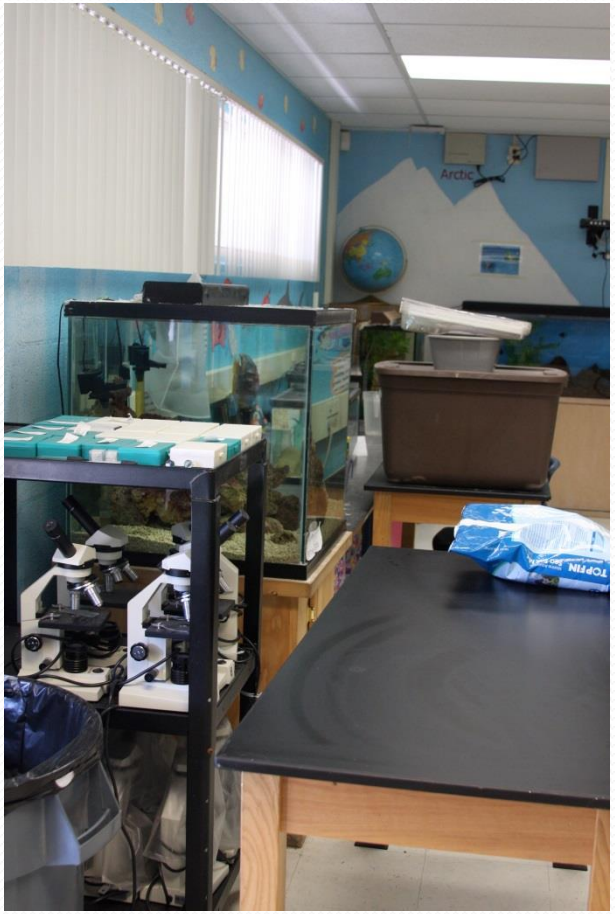
Presenters:

Kathleen Decker- Principal

Christine Herbert- Magnet Theme Coordinator

Sara Quintana- Aerospace Engineering and Robotics Teacher

It all starts with a dream…



What is Hydroponics?

- Hydroponics is the process of growing plants in media such as coco coir, rock wool, gravel, or liquid, with added nutrients but without soil.

Why Hydroponics?

- Naturally Grown-Pesticide Free
- Up to 40% faster growing rate
- 90% less water usage
- No Weeds or Pests
- Great Plant Quality and Taste
- Grow in Any Condition
- Smaller Growing Area

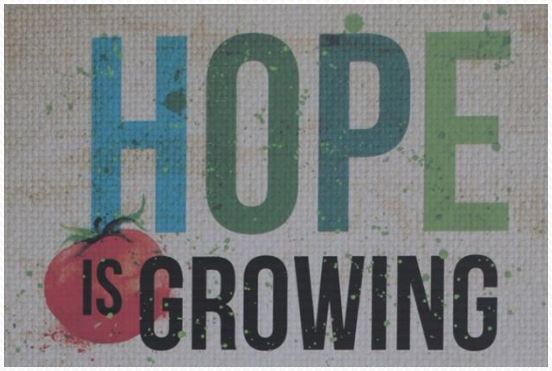
Ask everyone you meet for help in achieving it!

- Attend as many networking events as possible
- Talk to everyone who visits your school
- Use your tech tools- Spread the word on your Facebook, Instagram, Twitter, and other social media accounts

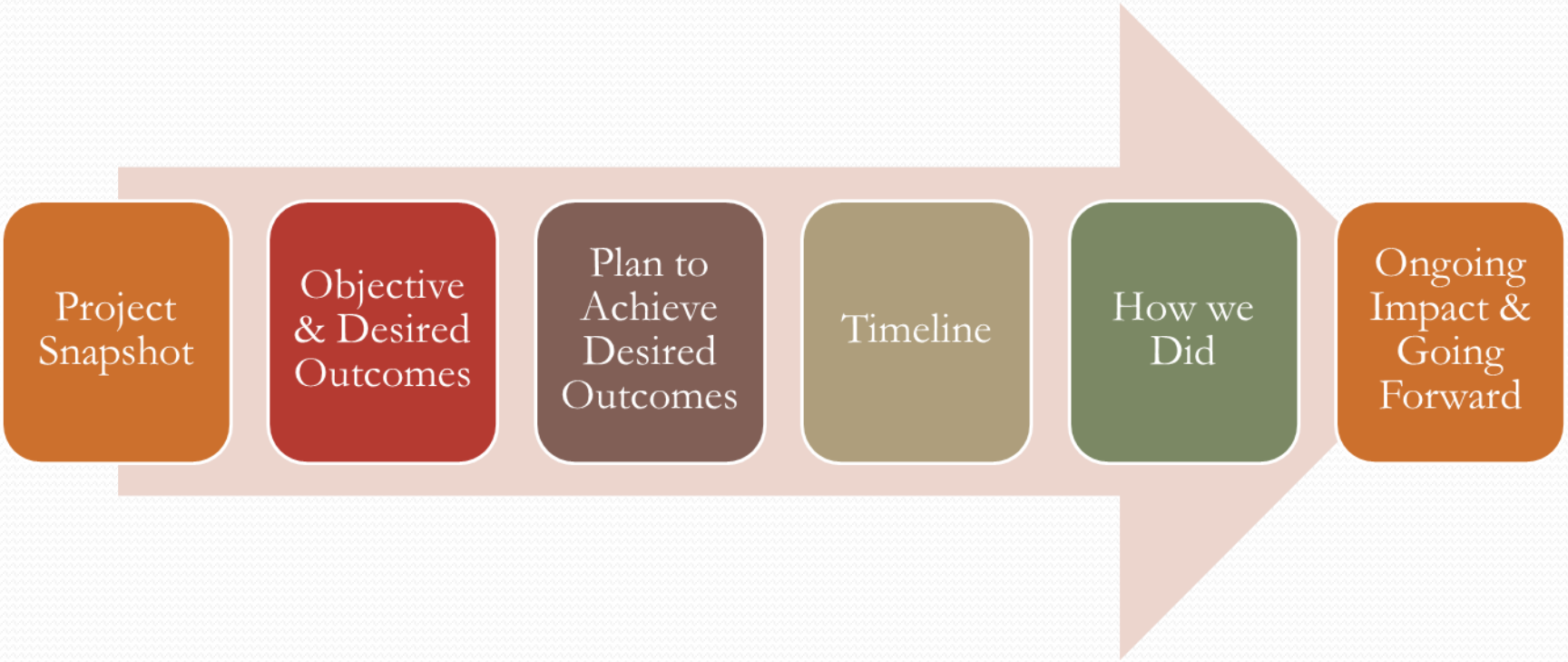
- Be very specific with what you are asking for and why it will make a difference

Chamber of Commerce Leadership Las Vegas

- What project can we take on that can improve the education and lives of our citizens?
- LLV 2014Class Project: H2O Grow: Hydroponic Gardens in Schools
- http://www.h2ogrowlv.com/



H2O Grow Agenda



Project Snapshot

- What: Create a sustainable program for hydroponic gardens in schools
- Where: CCSD schools
- Who: students/staff/community
- When: 2014/15 school year (then replicable)
- Why: See "Objective & Desired Outcomes" next

Objective:

Engage students with a unique, hands-on learning opportunity in the form of hydroponic gardens

Desired Outcomes:

- Improve student engagement & provide mentorship opportunities
- Enable teachers to create a unique and hands-on curriculum
- Beautify school spaces
- Enable students and their families to learn about healthy food

Plan to Achieve Desired Outcomes:

- Select 1-3 pilot schools
- Fundraise $7500-$18,000
- Establish partners for expertise/support

Timeline

Jan-Feb 2014

- Create project
- Form committees

Mar 2014

- Present to Chamber
- Receive Chamber approval

Apr-Jul 2014

- Finalize schools
- Solidify partners
- Plan
- Fundraise

Aug-Nov 2014

- Cowboy Trail learning day
- Mt. Charleston Library event
- Provide Garden Materials to Students

Dec 2014

- Officially launch program

Jan-Feb 2015

- Finalize E-Guide
- Brief Chamber
- Transition to other non-profit

Class Organization

			Lead		
			Mandy		
		Secretary	Co-Lead	Treasurer	
		Carolyn	Kiki Fab	Gina	
Fundraising Dir.	Education Dir.	Gardening Dir.	Marketing Dir.	Finance Dir.	Outreach Dir.
Brian	JMay / Paddy	Justin	Tonya / Mike D	Gina	Krista
Members	Members	Members	Members	Members	Members
Scott	John G	Tim	Brianna	Joe Ganley	Bill
Steve C	Bill	Roxxy	Anna	Harmony	Angela
Brad	Lezlie	John S	Sheila	Joe Mugan	Sallie
Paddy	Andy B	Chris M	Randy	Andy M	Adam
Joe G	Joy	Ramona	Lloyd	Chris J	JLo
Tamar		Sheree		Erin	Steve L
Lori		Brian			Kimberly
Dan		Joe M			Maren
		Maggie			
		Brianna			

Project Inspiration

Green Bronx Machine Vision

We believe that healthy students help drive healthy schools, and that healthy schools are at the heart of healthy communities.

Steve Ritz & Las Vegas

- Spoke at US Green Building Council, NV
- Spoke at the UNLV / Las Vegas Sands Sustainability Summit

School Partners

WALTER BRACKEN
STEAM
ACADEMY

Academy of Aerospace & Aviation
Academy of Medical & Allied Health
RANCHO HIGH SCHOOL

Community Partners

- Marilyn Yamamoto

COWBOY TRAIL FARMS

LOS VAQUEROS

GOOD GUYS · GREAT TIMES · GREATER CAUSES

Improving Las Vegas One Child, One Family At A Time

Fundraising

THE VENETIAN
Resort·Hotel·Casino

ESPN FANTASY FOOTBALL

goodwill

NEVADA STATE BANK
THE DOOR TO YOUR FUTURE

Where can you look?

Roots, Shoots & Garden Boots

Plan Events

- Percent days, where a business donates a percentage of their daily sales to your garden. 5 or 10% is typical.
- Special goods or menu items whose sales benefit your garden
- Special events, where a restaurant hosts an event and the proceeds benefit your garden
- Plain ol' garden sponsorships, where a business donates to the garden in exchange for recognition on signage, newsletters, social media, or in other ways
- School art shows, where student artists provide the art, and the proceeds go to the garden
- Garden-wide yard sales, where all proceeds go to the garden

Cowboy Trail Learning Day

Provide Garden Materials to Students

Construction

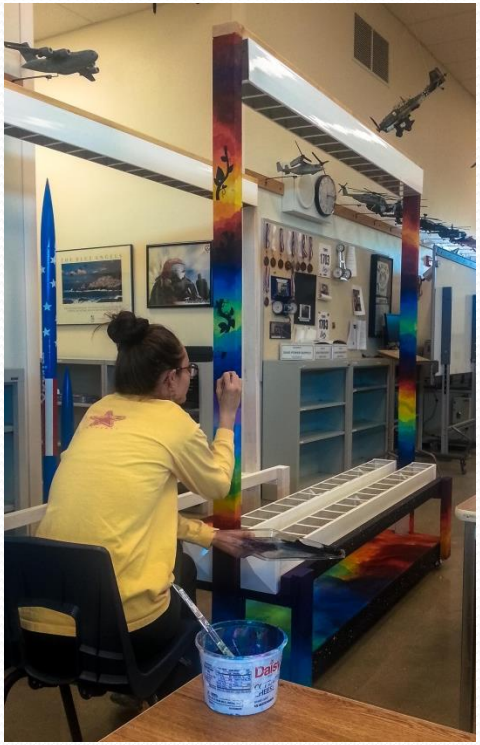
- Students were provided materials
- Reverse engineered design from model

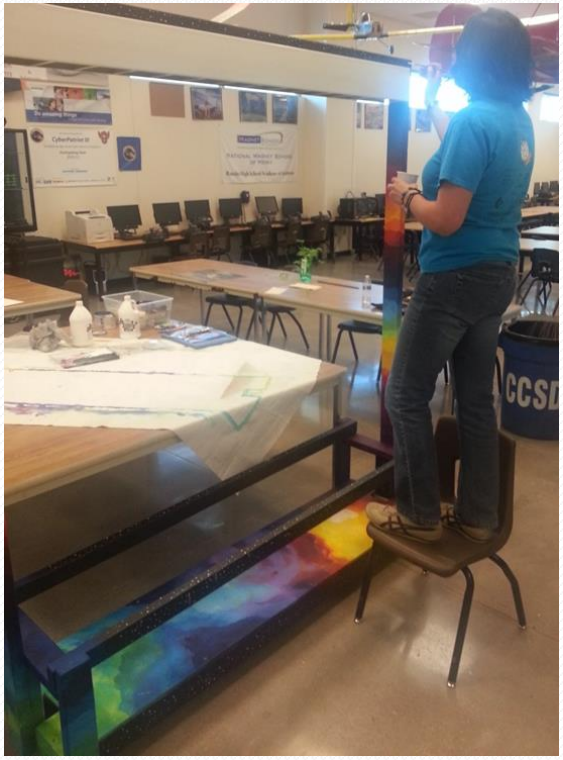
Decoration

- Local artist who specializes in wood offered to help
- Great opportunity for mentees

Decoration

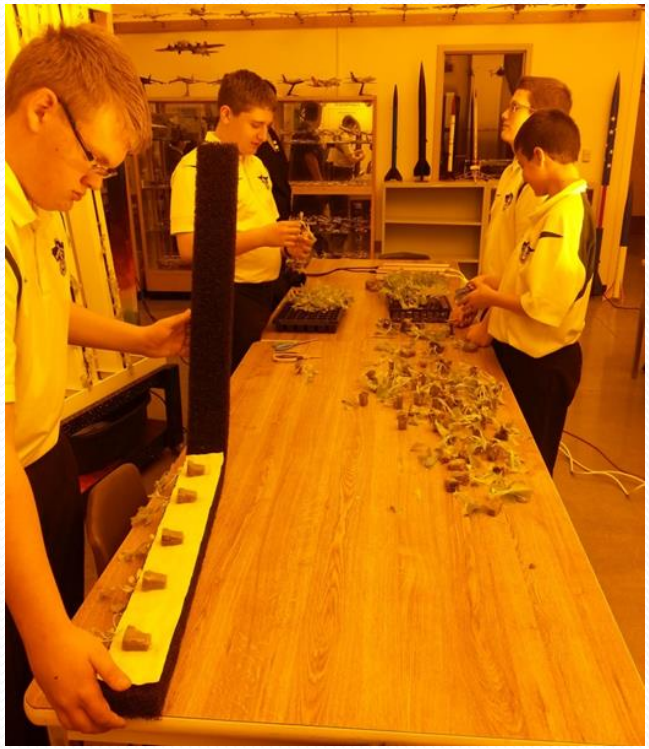
- The frames took 100+ hours to prime, paint and seal





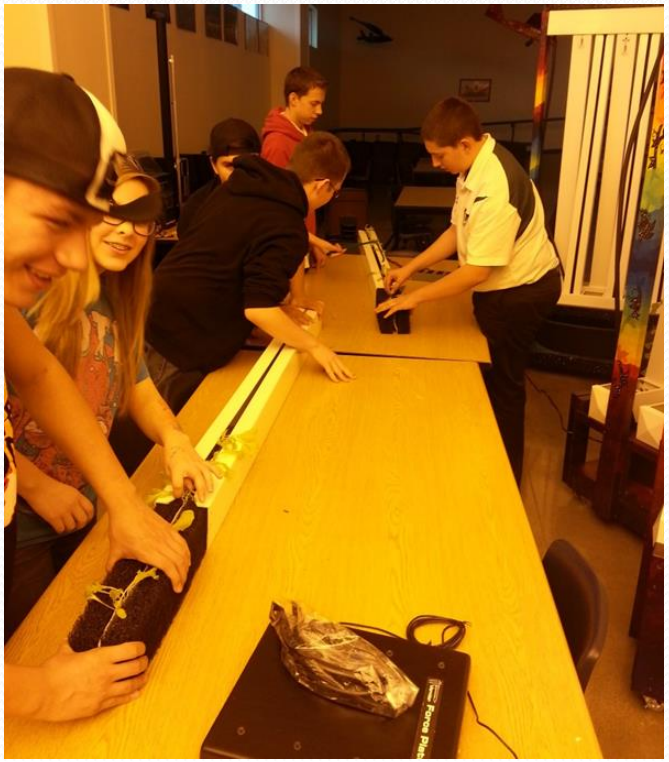
Installation

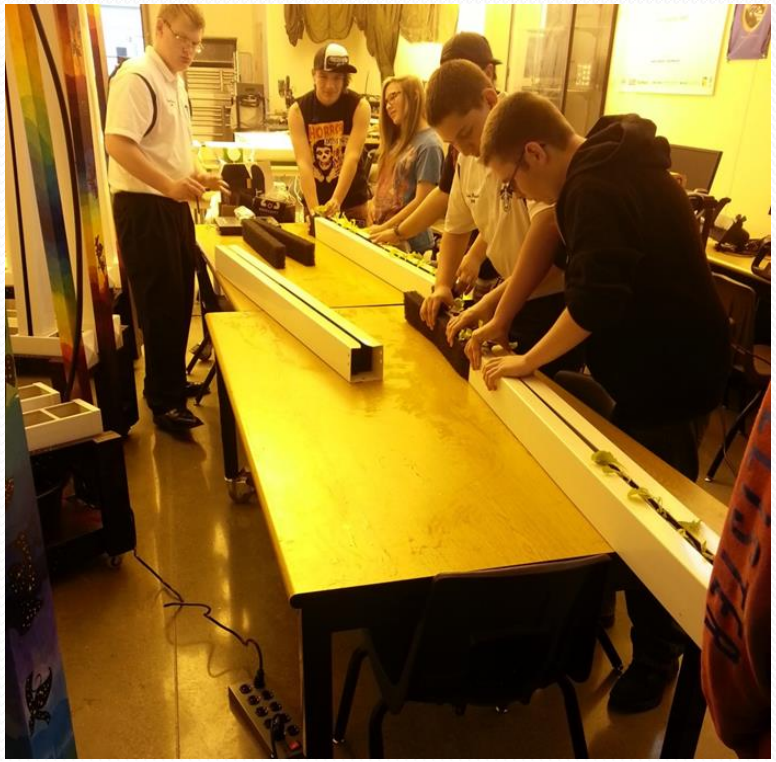
- Seedlings were delivered from local organic farm
- Students had to first separate each plant



Installation

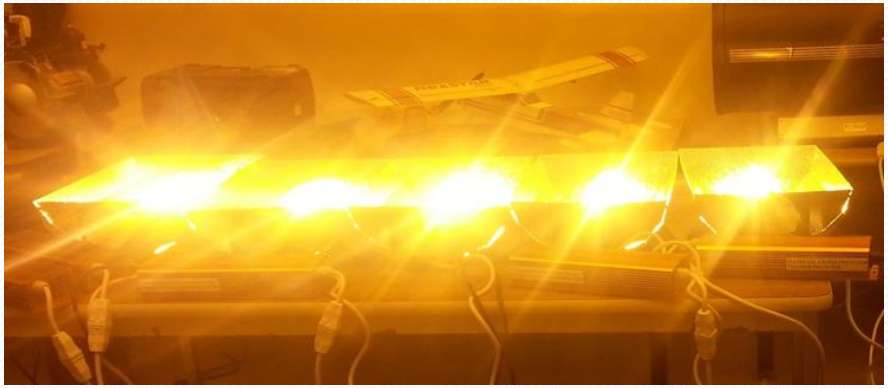
- Plants were placed into the pad/wicking material
- Material was closed and placed into towers

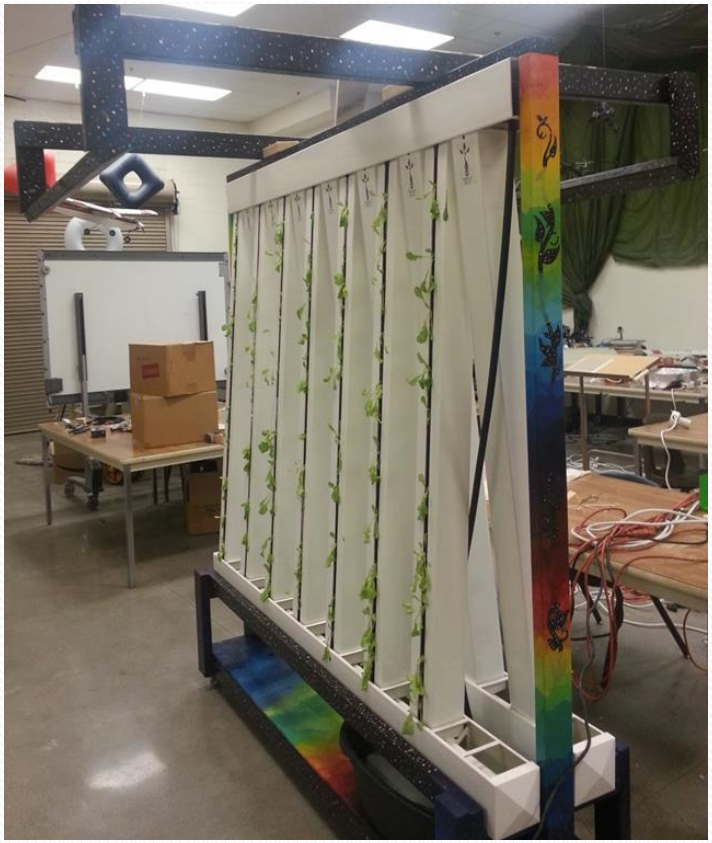




Lighting

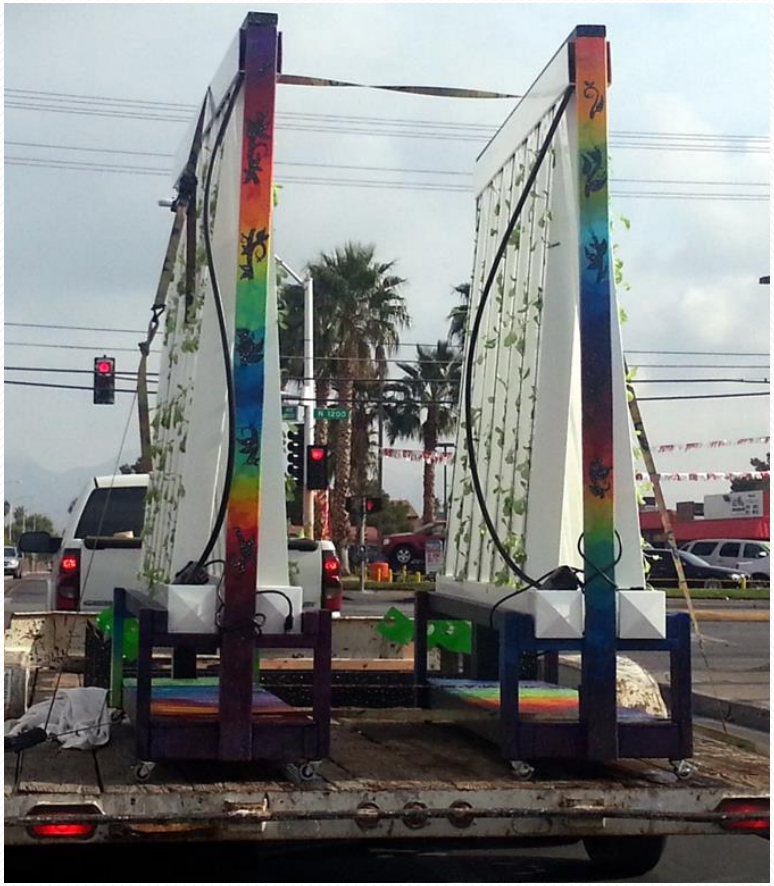
- 1000 Watt High Pressure Sodium x 16 for all 4 systems
- Student designed mounts

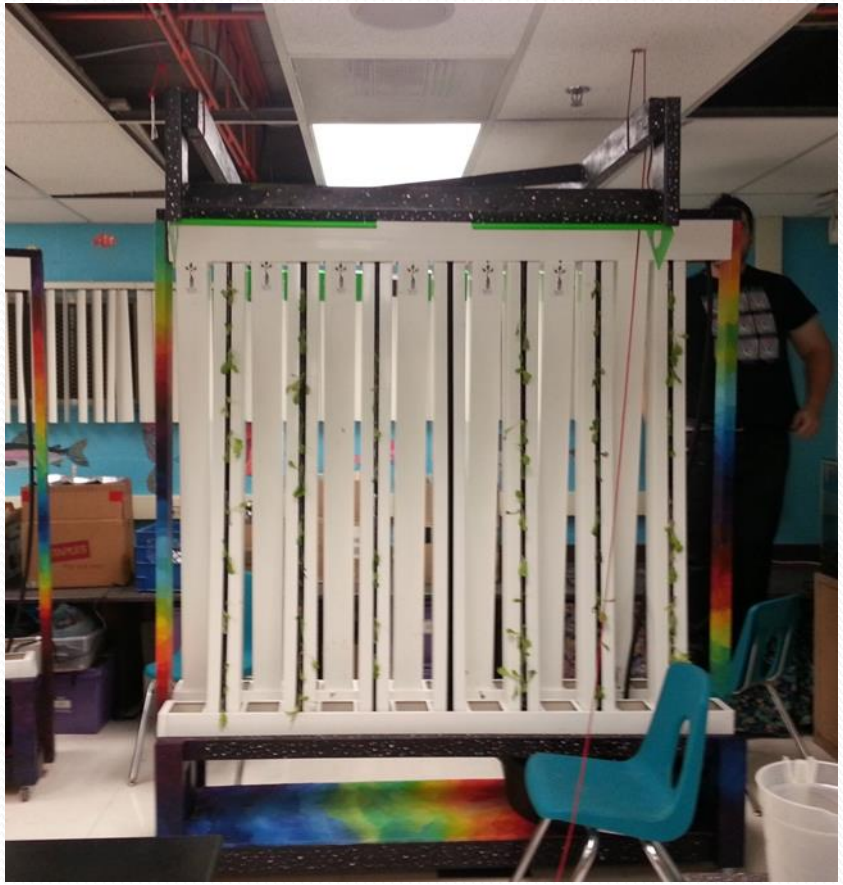




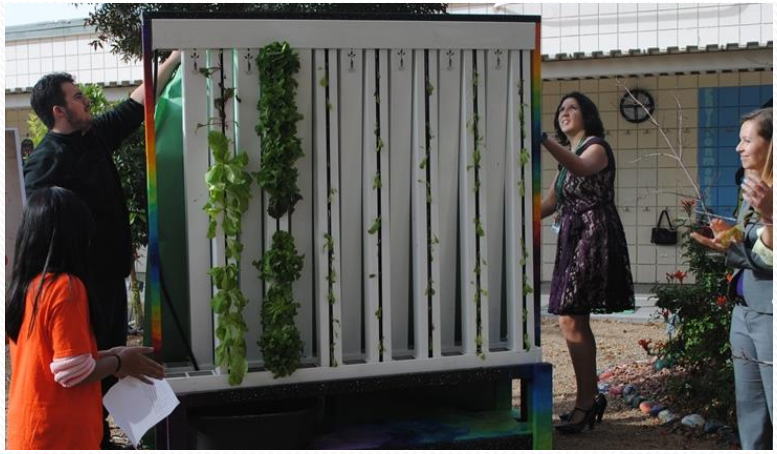
Delivery and Reinstallation

- The scariest part of the entire process!





Official Launch: Dec. 8, 2014

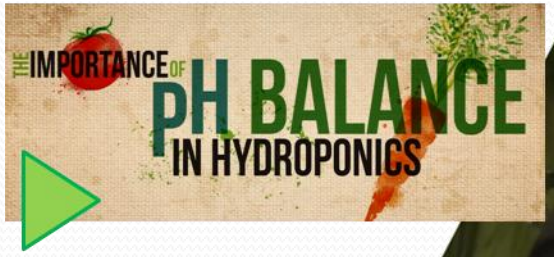



H2O GROW
THE GARDEN REVEAL
H2O GROW
THE GARDEN REVEAL
THANK YOU

Where do we go from here?

- Leadership Las Vegas Class
  - H2O Grow How to Guide
  - You Tube videos
- Bracken
  - Created an Implementation Plan
  - Research and created curriculum
  - Aquaponics to be added
- Rancho
  - Advance Project
  - Hydroponics for Culinary Students

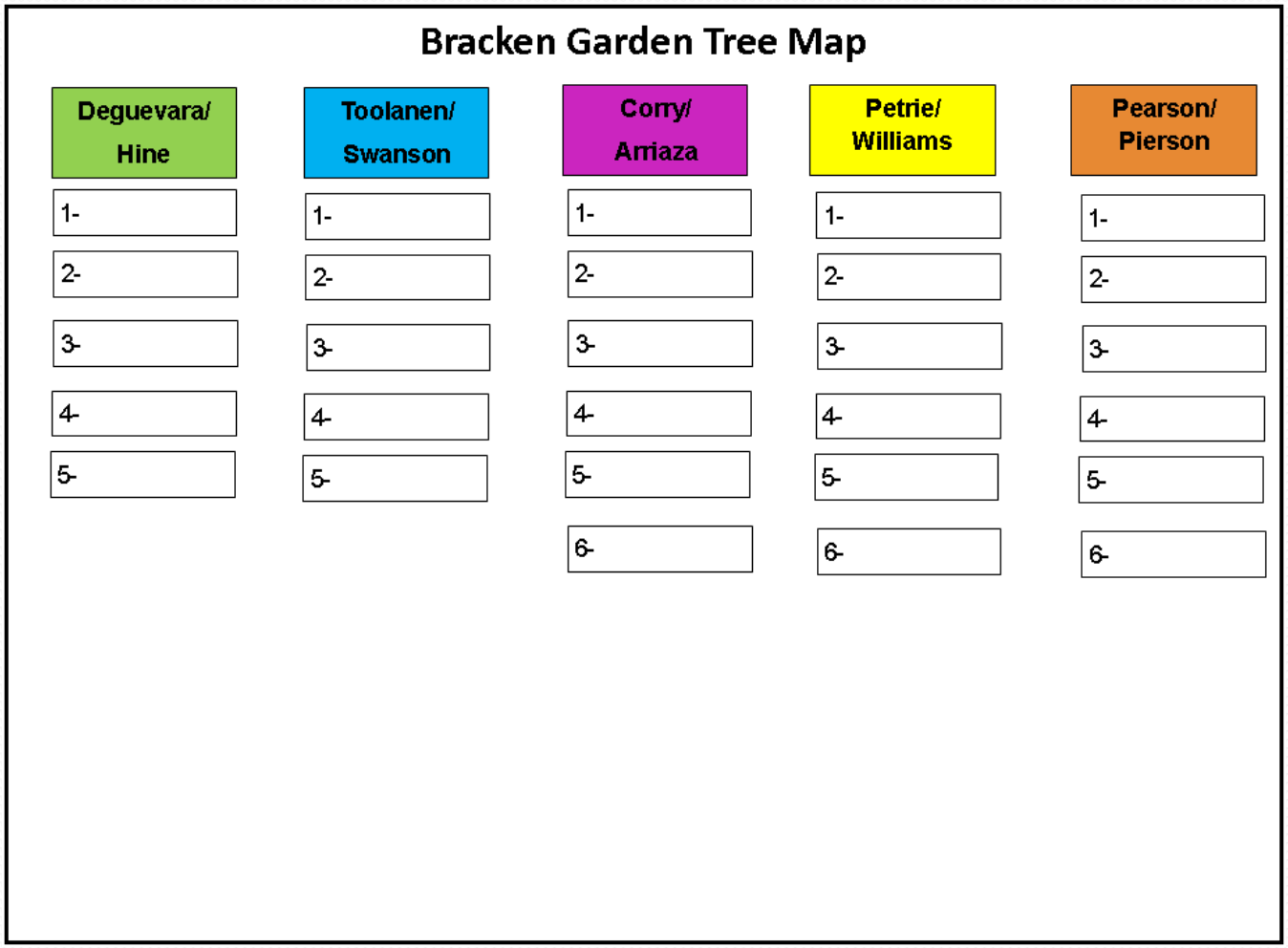
H2O Grow E-Guide:
Videos on How to Build & Care for the Gardens
http://www.h2ogrowlv.com/how-to-guide/



Implementation Plan

- Create 1st-2nd grade teams
- Assign towers
- Create a record system
- 1st grade students germinate the seeds
- 2nd grade student replant in the towers, grow, and harvest fruits and vegetables

Hydroponics Teams



Map of the Towers

Hydroponics Grow Lab

D1	D2	D3	D4	D5	T1	T2
CP1	CP2	CP3	CP4	CP5	CP6	JP1

T3	T4	T5	C1	C2	C3	C4
JP2	JP3	JP4	JP5	JP6	C5	C6

Farmer Key:

D= Deguevara

T= Toolanen

C= Corry

CP= Petrie

JP= Pearson

The numbers represent each garden tower. See Tree Map for what is planted in each tower.

Record Charts

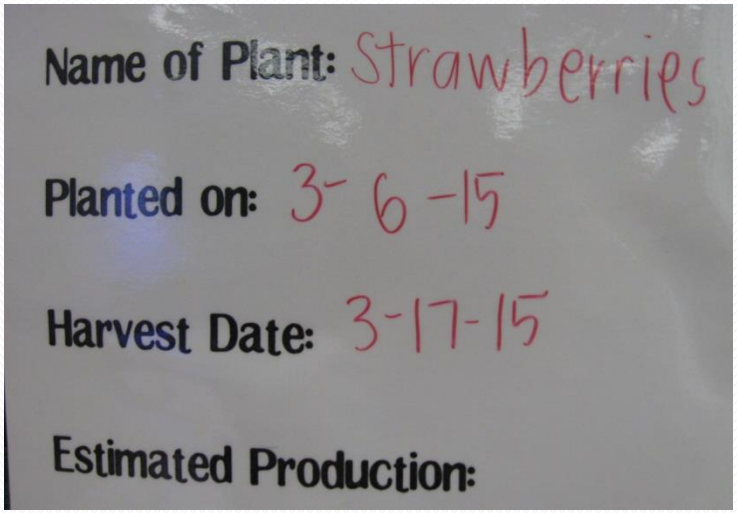
Garden Bed 1

Name of Plant:

Planted on:

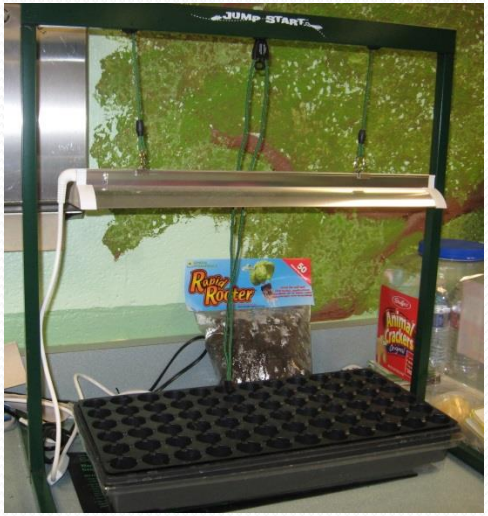
Harvest Date:___

Estimated Production:_____



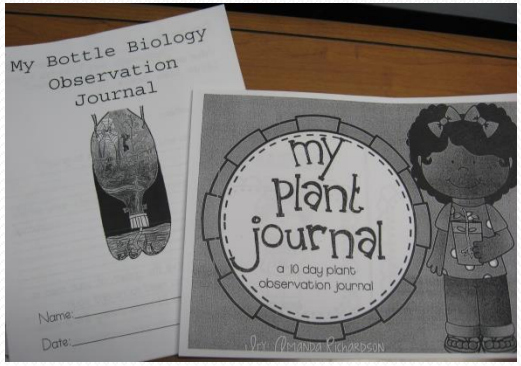
1st Grade Germinators

- We created a system to have our 1st grade students germinate for our 2nd grade hydroponic growers.

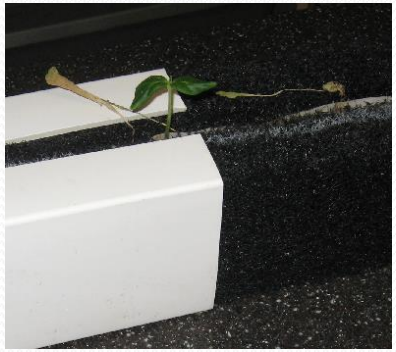


Curriculum

- Vocabulary
- Observing, Recording, Journaling
- Blogging
  - http://brackengarden.weeblv.com
- Measuring
- Life Cycle of Plants
- Ecosystems

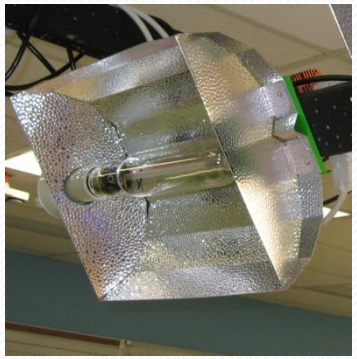


2nd Grade Growers



What our systems look like today

Our Future Looks Bright

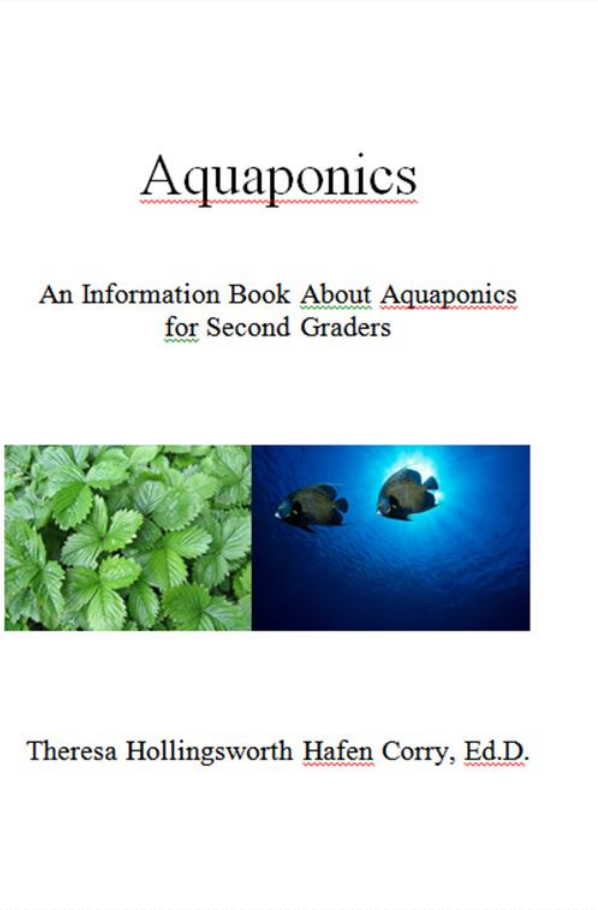


- Aquaponics- combines hydroponics and recirculating aquaculture(RAS). The plants provide clean water for the fish. The fish waste provides nutrients for the plants. The microbes break down the fish waste into good food for the plants. Both the plants and the fish can be harvested. The water remains in the system and is used over and over again.

Future Curriculum

Interdependent Relationships in Ecosystems
Aquaponics Unit
Lesson 1: Aquaponics Introduction

Title	Aquaponics Bracelet
Grade Level	Second
Standards	SCIENCE 2-LS2-1. Plan and conduct an investigation to determine if plants need sunlight and water to grow. Science and Engineering Practices: Planning and Carrying Out Investigations – Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence to answer a question. Disciplinary Core Ideas: LS2.A: Interdependent Relationships in Ecosystems – Plants depend on water and light to grow. Crosscutting Concepts: Cause and Effect – Events have causes that generate observable patterns. ELA/LITERACY RI.2.1 Ask and answer such questions as who, what, where, when, why, and how to demonstrate understanding of key details in a text. RI.2.3 Describe the connection between a series of historical events, scientific ideas or concepts, or steps in technical procedures in a text. W.2.8 Recall information from experiences or gather information from provided sources to answer a question. SL.2.2 Recount or describe key ideas or details from a text read aloud or information presented orally or through other media.
Materials	You Tube video prepped to share, *Aquaponic Bracelet* paper (one for each student), large white boards, Chenille sticks (one for each student), Aquaponics Cards, Plastic Beads – blue, yellow, green, white, black (one of each color for each student), *Aquaponics* book
Step 1: Orientation and Motivation	Call students to the carpet, and ask students to think about what they know about water, plants, and fish. Give think time. Then, have students pair and share a couple of times. Point out a few ideas (that are accurate) that students shared without stating the students' names. Tell students that they will be watching a segment of a video about aquaponics. Ask them to listen for how water, plants, and fish interact. Share the You Tube video titled What Is Aquaponics? How it Works and Why an Aquaponic Setup Can Fail (from about 2:40-3:50, 11:00-14:30, and 16:00-21:30).



Rancho: Advanced Project Idea

- Too busy to maintain system
- Solution: Automate it!
- Presented to top robotics students
- Ardunio-based system to monitor and adjust levels remotely

Funding

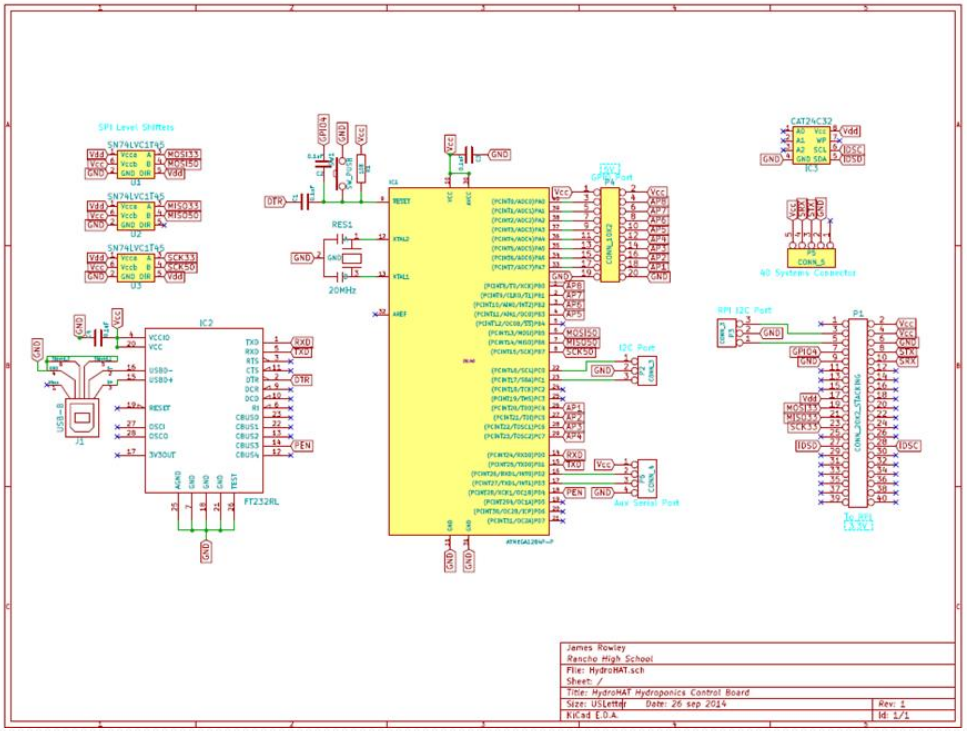
- Base system was provided through a philanthropy project by the Leadership Las Vegas Class of 2014
- Ask, and ye shall receive!
- Lighting: HTG Supply
- Software: EMA Design Automation, OrCAD
- Solar Panels: Bombard Electric
- Artwork: Allison Streater

Water Chemistry

Temperature	~70° F
pH	~6
Electric Conductivity	Seedlings: ≤ 1.0 Bloom: 2.4
Dissolved Oxygen	Unnecessary in continuous flow Otherwise, airstone

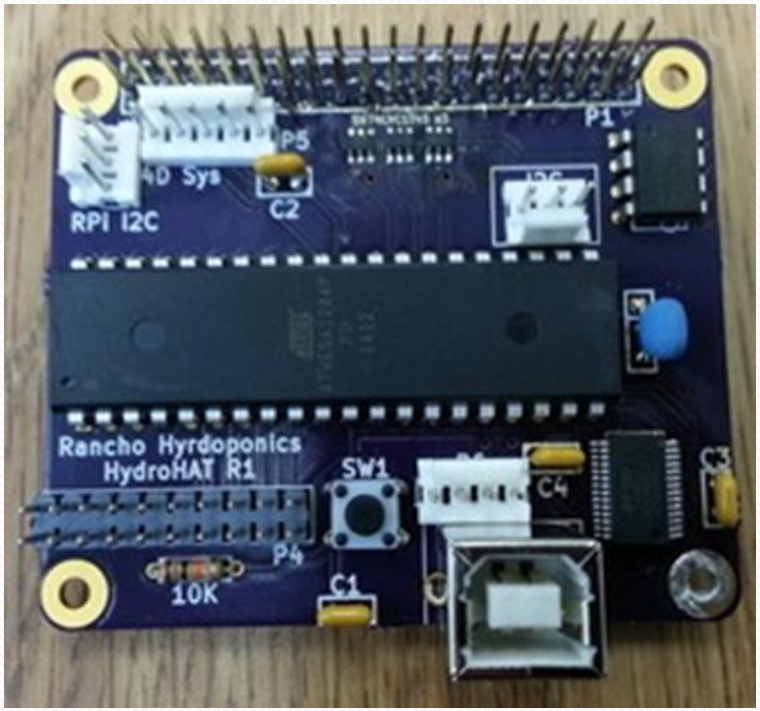
Development

- Single board computer (SBC) using Raspberry Pi B+ Hardware Attached on Top (HAT) board dubbed the “HydroHAT” and a TI Sitara AM3874 SoC processor



Development

- Custom ordered printed circuit boards (PCB)



Structure of Advanced Project

- Engineering design process
- Structured deadlines and deliverable dates
- Required to keep a project development blog
- http://blag.mcepic.com
- But that's only a few students…

Freshmen Engineering Design

- Engineering Design Process
- Within Clark County School District, the fifth largest in the country, over 55% of students are on free or reduced lunch
- Students were tasked with developing small scale hydroponic gardens to grow produce at home

Initial Requirements

- Be able to be mass produced by hand
- Constructed from repurposed plastic bottles
- Include a sketch and verbal description of their design
- Affordable
- Consult with other groups – 3 ways to improve, 3 things they liked
- Redesign their garden using provided suggestions
- Include a budget, supply list, and directions
- Development log

Third Revision

- Builds were too expensive!
- Told personal story about growing up
- New constraint added: $5 limit for design
- Redesign, build prototype, and produce formal presentation

Formal Presentation Requirements

- Minimum 5 minutes
- Computer drawn model or sketch with dimensions
- Summary of design development
- Budget with supply list
- Clear construction directions
- What made their product “the best”
- Working prototype as a demonstration
- Made using computer based presentation software
- Every group member has to speak

Post Presentation

- Have a gallery walk of all projects
- Students vote on their favorite design, and cannot vote for themselves
- Have a run off between the top designs from each class
- Winner selected presented design to principal along with a proposal to develop a program that provides some materials, and build and grow directions to students in need

The Design is STILL Working

- Charlie Sheen the Lima Bean
- Planted in September 2014
- Filled the reservoir twice

Reflection Essay

- Five paragraph essay
- Three distinct things learned
- Graded feedback
- Helps students analyze what they learned
- Helps me improve my lessons

Feedback Received From Freshmen

- "Once we built the prototype, we realized our design had some major flaws. The medium in our plant holder wasn't working very well. We were not able to tell this from a drawing on a computer or graph paper…"
- "To me, this was a very effective way of practicing the engineering design process because I was put through using it in a real life design, not just an example on a piece of paper. This allows me to have a good memory of the process without looking at my notes at all."
- "Overall, the hydroponic project taught us many things… this assignment made us realize the importance of cost, time management, and the ability to collaborate with a group of people… This project helped us grow in our engineering and in our day to day lives."
- "What I liked about this project is the creative freedom and how we had to make our products entirely on our own."
- "I finally realized that I should try to help those in need more than others, instead of making fun of them."
- "…it shows me how much the field of engineering is linked to society and the world around us."

Resources

- Grow with the Flow Curriculum
- http://ecommons.library.cornell.edu/bitstream/1813/9506/2/Grow%20with%20the%20Flow.pdf
- Kids Gardening
- http://www.kidsgardening.org/node/3817
- http://www.kidsgardening.org/node/3760
- http://www.kidsgardening.org/node/3820
- Boswyck Farms
- http://www.boswyckfarms.org/wp-content/uploads/2013/12/Boswyck-Farms-STEM-Education-through-Hydroponics2.pdf