

Making MS 447's Garden Last

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Summary/Overview: Students will expand MS 447's recycling program from a focus on paper recycling and place an additional emphasis on the recycling of plastic bottles. Students will then repurpose the bottles into the siding of a new greenhouse. We will use the greenhouse to begin seedling for our outdoor garden in our state-of-the-art Aeroponic system. Students will be responsible for monitoring the collection of the bottles and will also engineer, build, and maintain our new outdoor greenhouse and Aeroponic system. The end goal of this project is to expose students to engineering and agriculture and to promote stewardship of the environment.

Big Idea(s):

1. Cycles: every organism and every system goes through different stages.
2. Community: a group of living and nonliving things sharing a common purpose or space.
3. Interdependence: all living things are connected. Every organism, system, and place depends on others.

Essential Question(s):

1. How can we build and maintain an edible garden that provides fruits and vegetables year round?
2. How can we repurpose materials to build a greenhouse to extend our growing season at MS 447?

Student Outcomes:

1. Students will be able to collaborate with each other to coordinate plastic bottle collections campaigns.
2. Students will learn how plants grow, and will use that knowledge to build and maintain an indoor Aeroponic system.
3. Students will be able to use knowledge agriculture to plant and cultivate an edible garden.
4. Students will be able to use basic building tools (i.e. Drill, handsaw, hammer, level) to construct a freestanding, functional greenhouse.

Time: 15 Fridays from 2:30-4:30

Vocabulary:

| | | |
|-----------|-----------------|-----------|
| Aeroponic | Interdependence | Minerals |
| pH | Nitrogen | Compost |
| Nutrients | Phosphorous | Organic |
| Rockwool | Humus | Inorganic |

Tools, Materials, Supplies:

| Tools and Building Materials | |
|--------------------------------|----------------------------|
| Drills (4) 2" bit | Nails |
| Hammers (4-6) | Screws |
| Level | Wood as per building plans |
| Handsaws (2) | Bamboo stakes |
| Circular saw (1-for adult use) | |

| Aeroponic Supplies | |
|--------------------|----------------|
| Aerator | Seeds |
| Tubing | Nutrients |
| Rockwool | Bubbler stones |
| Plastic tubs | Chopsticks |
| pH adjuster | Soil |
| Seeds | |

Preparation:

- Send in Grow to Learn mini-grant application for Greenhouse
- Order supplies for Aeroponic
- Test out the building of Aeroponic
- Arrange a place for plastic bottle collection

Background:

Aeroponics is a great alternative for growing plants in small spaces, especially indoors. Aeroponics is similar to hydroponics, as neither method uses soil to grow plants; however, with hydroponics, water is used as a growing medium. In Aeroponics, no growing medium is used. Instead, the roots of plants are suspended or hung in a dark chamber and periodically sprayed with nutrient-rich solution. Growing with Aeroponics is not difficult and the benefits far outweigh any drawbacks. Nearly any plant can be successfully grown using Aeroponics,

especially vegetables. The plants grow faster, yield more, and are generally healthier than those grown in soil.

Feeding for Aeroponics is also easy, as Aeroponic-grown plants typically require less nutrients and water. Regardless of the system used indoors, Aeroponic requires little space, making this method of growing plants especially suited to urban dwellers and the like. Typically, Aeroponic plants are suspended (usually inserted in the top) over a reservoir within some type of sealed container. Feeding for Aeroponics is accomplished through the use of a pump and sprinkler system, which periodically sprays nutrient-rich solution onto the plant roots.

About the only drawback to growing with aeroponics is keeping everything thoroughly clean, as its continually moist environment is more susceptible to bacteria growth. It can also get expensive.

From: <http://www.gardeningknowhow.com/special/containers/growing-with-aeroponics-what-is-aeroponics.htm>

Classroom Activities:

Day 1: January 23: Welcome to Garden Club

Question: How can we build a sustainable garden?

Engage: Brainstorm- How can we build a sustainable garden?

Explain: Show students 3 min clip of a school in Georgia who has build a plastic bottle greenhouse.

Explore: Make a plan with students as to how we will go about collecting plastic bottles for our greenhouse. Have students work together to create posters and announcements to make the ms 447 communities aware of our project.

Evaluate: As a wrap-up, students will talk about why we should use plastic bottles instead of materials that we have purchased.

Day 2: January 30 Intro to Aeroponics and Tool Safety

Materials: Drill, saw, hammer, wood, nails, screws, safety goggles, work gloves, 2in round drill bit, plastic Aeroponic tub.

Engage: Brainstorm: How do we use tools safely? Share out ideas and establish ground rules.

Explain: Demo Each of the tools (hammer, drill, saw)

Explore: In stations, have each of the student practice with the tools with adult supervision.

Elaborate: Show students a model of the Aeroponic system. Explain that over the next couple of weeks we will be setting up our own indoor Aeroponic system and learning more about how the system works. Today, we will start to build the system by boring holes in the top of the plastic tote bins using a drill.

Elaborate: Students will sit in a circle and take turns drill holes in the top using 2 in drill bit.

Wrap-up: Indoor plant maintenance (as necessary)

Day 3: February 6: Aeroponic System Building

Pre-Activity Questions: How does aeroponics work?

Materials: Container with holes (from last week), H₂O, rock bubblers, tubing, aerator, nutrient mix, pH meter, seeds, rockwool

Engage: Ask students, what do plants need to grow?

Explain: Teach speak: Student may say that plants need soil. Ask, “What specifically do plants need from soil. Introduce the nutrient mix to students. Together read the bottle to discover the nutrient ratios then calculate the amount of nutrient mix to add to the H₂O.

Assign a student to measure out the nutrient mix and measure H₂O. Add to tub.

Ask: How are we going to get the water and nutrients to the soil? Show students the bubble and explain how it works. Set up the bubbler, hose, and aerator with the students.

Show students the rockwool. Let them observe and note any features. Explain that Rockwool is a medium. Define “medium” as a group.

Students will select seeds to plant in the rockwool. Each student will plant 1-2 seeds.

Wrap-Up: Garden Maintenance (as needed)

Day 4: February 13: Plastic Bottle/ Milk Carton Bird Feeders

Pre-Activity Questions: What organisms does a garden need to grow?

Engage: A garden cannot grow on it's own. Give students a soil sample. Have students use light microscopes to look through the soil sample and identify any organisms or mater that might be found in the soil.

Explain: Have students share out what they saw. Explain that soil is actually made up of many parts and contains both organic and inorganic materials. Have students watch a Brainpop on soil: <https://www.brainpop.com/science/earthsystem/soil/> . Watch Brainpop nitrogen cycle

Teach Speak: Where does the nitrogen in our garden soil come from? Soil is formed from the interaction of plants, animals, rocks, and minerals. Since during the winter months it can be difficult for animals to find food, we need to provide food for them. Explain to students that they will be building a bird feeder out of recycled materials. Show students how to assemble the birdfeeder



Explore: Students will build the birdfeeder.

Wrap-up: Garden Maintenance (As needed)

Day 5: February 27: Begin Work on Greenhouse siding

Pre-Activity Questions: How does a greenhouse work?

Day 6: March 6: Continue to work on Greenhouse Siding

Pre-Activity Questions: How does a greenhouse work?

Day 7: March 13: Set Up out Door Pig Compost

Pre-Activity Questions: How does compost work? Why is it important?

Day 8: March 20: Plant Seedlings

Pre-Activity Questions: When can we begin to plant our garden outdoors? What does cold weather do to garden growth?



Day 9: March 27: Outdoor Greenhouse Assembly

Pre-Activity Questions: How can we work together as a community to build a greenhouse?

Day 10: April 17: Outdoor Greenhouse Assembly

Pre-Activity Questions: How can we work together as a community to build a greenhouse?

Day 11: April 24: Outdoor Greenhouse Assembly

Pre-Activity Questions: How can we work together as a community to build a greenhouse?

Day 12: May 1: Outdoor Greenhouse Assembly

Pre-Activity Questions: How can we work together as a community to build a greenhouse?

Day 13: May 8: Plant raised beds

Pre-Activity Questions: How can we make our garden ready to receive plants?

Day 14: May 15: Plant raised beds

Assign Roles: What does a garden need to be successful?

Day 15: May 22: Garden Maintenance

Assign Roles: What does a garden need to be successful?

Day 16: May 29: Garden Maintenance

Pre-Activity Questions: What does a garden need to be successful?

Day 17: June 5: Garden Maintenance

Pre-Activity Questions: What does a garden need to be successful?

Day 18: June 12: Garden Maintenance

Pre-Activity Questions: What does a garden need to be successful?

Day 19: June 19 Last Day: Harvest Party

Pre-Activity Questions: How can we use the plants we have grown to make a delicious and nutritious meal?

Accompanying Worksheets/Tasks: See attached

Standards

EFS: |C| The Dynamics of Systems & Change A system is made up of two or more parts in a dynamic relationship that forms a whole whose elements ‘hang together’ and change because they continually affect each other over time. Students will know and understand the dynamic nature of complex systems and change over time. They will be able to apply the tools and concepts of system dynamics and systems thinking in their present lives, and to inform the choices that will affect our future.

CCLS Literacy: Reading Standards for Literacy in Science and Technical Subjects 6–12

Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.

CCLS Mathematics - Grade 7:

Geometry

Solve real-life and mathematical problems involving angle measure, area, surface area, and volume.

The Number System

Apply and extend previous understandings of operations with fractions to add, subtract, multiply, and divide rational numbers.

Science: Next Generation Science Standards

MS-ETS1-1. Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.

NYC Scope and Sequence

Patterns of Development and the Continuity of Life

- Patterns of development in plants LE 4.3a,b, c, elf added b

Food Chains and Food Webs

- Role(s) of consumers: idea of respiration/ recycling; herbivores/ carnivores/omnivores. LE 5.1d,e LE 5.2b,c-e • The role of decomposers. LE 5.1e
- Flow of energy and matter through food chains and food webs LE 5.1c LE 5.2a LE 6.1a-c • Methods for obtaining nutrients LE 5.1d,e deleted LE 5.2b • Role of producers LE 6.2a-c