

Title: Exploring Water Garden Ecosystems

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Lesson Overview

Students will use the knowledge they gained from the Belle Isle Aquarium field trip to create hypotheses on how the water garden in the classroom works. The students will use a 2-liter bottle to construct their own aquatic ecosystem with a mini-water garden, including a fish to take home. Students will then explain how the plants in both the water garden and the aquatic ecosystem in the bottle utilize and remove the Nitrates in the fish waste from the water that then goes back into the tank.

Teacher Background

The class has already visited the Belle Isle Aquarium and has learned that the Nitrate in the water from fish wastes is the same chemical that is in fertilizers. At the aquarium, students learned that the tanks have plants that filter the nitrates to keep the water safe (clean) for fish. Our class will have a water garden that essentially does the same thing, with the help from a pump so the water reaches the plants above the water. The students have background knowledge that an ecosystem is living and nonliving things interacting. The students will construct a 2-liter bottle terrarium, but will attach a mop string from the bottom water to the plants on top. The string will carry the nutrient-rich water to the small plant on top, keeping it watered. Students must still feed the fish. As they learned that the aquarium tanks do not have a complete food chain, neither is theirs.

Target Grade & Subject: 5th Grade, Science

Duration: 1-2 class periods (may need more time for assembly of individual water gardens)

Instructional Setting: Classroom

Advance Preparation: Have the class water garden set up and functioning at least for 2 weeks in advance, so students see the plants starting to grow. When planning to have students create their own water gardens, have aquarium rocks, soil, string, coffee filters, and seeds ready. Students will bring in their own 2-liter plastic bottles.

Learning Objectives

At the end of this lesson, students will be able to:

1. What do plants need to live and what do animals need?
2. Explain how the water garden works.
3. Compare the water garden to the tanks at the Belle Isle Aquarium.
4. Describe how their water gardens are ecosystems.

Michigan Science (or Social Studies) Performance Expectation Addressed

(<http://ngss.nsta.org/Professional-Learning.aspx>)

5-LS2-1. Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment.

SEP: Science & Engineering Practices

Developing and Using Models

DCI: Disciplinary Core Ideas

LS2.B Matter cycles between living things in an ecosystem

LS2.B Interdependent Relationships in Ecosystems

CCC: Cross-Cutting Concepts:

Systems and System Models A system can be described in terms of its components and their interactions.

List Materials & Quantities Needed per class and per student group

Per class

1 water garden

https://backtotheroots.com/products/watergarden?gclid=CjwKCAjw85zdBRB6EiwAov3RitPQMb8MbXNuKidUSR7wX61_qLyPwqkPcvDaS8m-MK3f3jRjzKXE7h0CbEoQAvD_BwE

Per student

1 cup of rocks

12" cotton string (about the thickness of a mop string and the length of the 2-liter bottle from bottom to top)

1 coffee filter

2-liter bottle – *each student needs to bring in.* Using scissors, cut off the top 1/3 of the bottle

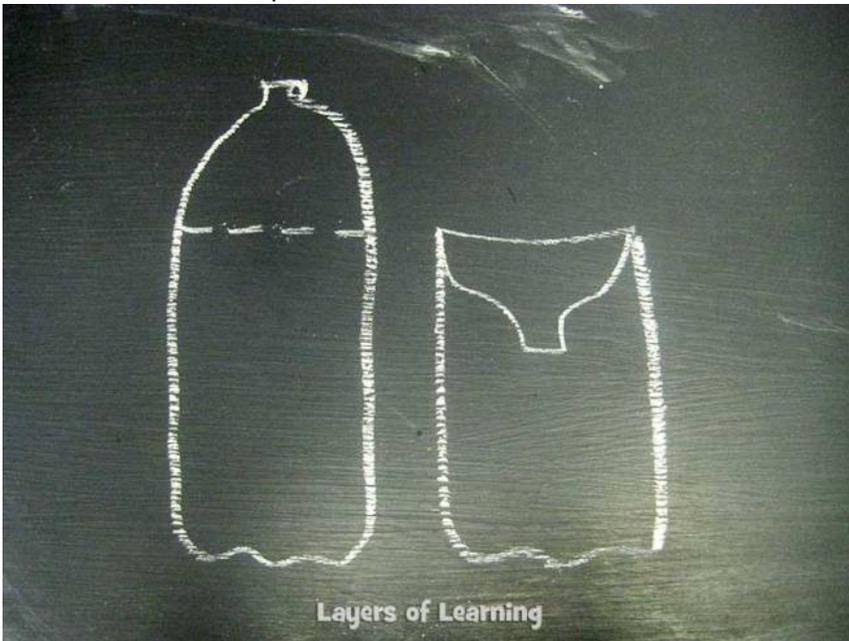
1 cup potting soil

3-5 grass seeds

1 instructional sheet

1 take-home instruction sheet

How to cut the 2-Liter plastic bottle



Guiding Question(s): Write on board. Students write on instructional sheet.

How does the water garden work?

How is the water garden like an ecosystem?

5E Lesson Plan Model

ENGAGE:

I will place the water garden in the front of the room. I will explain to the students that I have never cleaned the tank, but it's not dirty. I have never had to water or fertilize the plants on top, but they are growing. I will activate prior knowledge of what plants need to grow, so students make the connection of water having to be involved. Remind the students if they have ever had a fish tank, it gets dirty and you need to clean it, so why not this one? Ask the Guiding Question: How does the water garden work?

Expected prior knowledge: *Students will know what an ecosystem is. They have already been to the Belle Isle Aquarium so they have some knowledge of how the plants help filter the tanks.*

Together with students, write a definition on the whiteboard:

An ecosystem includes all of the living things (plants, animals and organisms) in a given area, interacting with each other, and also with their non-living environments (air, water, sun, soil). In an ecosystem, each organism has its own niche or role to play.

Show the students the video “**Understanding Ecosystems for Kids: Producers, Consumers, Decomposers**” prior to starting the exploration task. <https://www.youtube.com/watch?v=bJEToQ49Yjc>

EXPLORE:

The teacher will ask questions about the aquarium tanks and what we know about how they work

The teacher will ask:

Does our water garden have a complete food chain?

How does that compare to the aquarium?

Students will come up and observe the tank by walking around and looking at all the moving parts.

The teacher will continue to ask questions as students explore:

What do we know plants need to live and what do we know animals need?

After exploring & observing, students will create a hypothesis (working with a partner or small group) for how they think the water garden works. They will write their hypothesis on their instruction sheet or science journal or a whiteboard.

Have all students take out their 2-liter bottles (cut off top one-third at home if possible, otherwise cut them before lesson. Both parts are needed.)

Explain that we are going to construct our own water gardens to help us understand how they work. During the construction process, students can revise their hypothesis if they gain new information.

1. Have each student put one cup of rocks in the bottom of their bottles. Ask-- *Is this different or the same as our water garden?*
2. Have each student tie a knot in their string. Have them poke a hole in the bottom of their coffee filter and place the coffee filter in the top of the cut two-liter bottle. Then have them push the string (end without knot) through the coffee filter hole so that it hangs off the bottom.
3. Put a cup of soil inside each filter so it fills the top one-third of the bottle. Ask-- *how is this part represented in our water garden?*
4. Plant the grass seeds into the soil in the top one-third of the plastic 2-liter bottle. Seeds should be planted no deeper than the length of the seed.
5. Fill the bottom of the two-liter bottle with enough water (4-6”) for a fish to swim in. *Make sure the water is room temperature so it doesn’t shock the fish.* Place the top one-third of the bottle on top of the bottom two-thirds of the cut 2-liter plastic bottle.
 - a. Before adding the fish have the students stop and explain how their water garden is similar and different to the classroom water garden? What is the purpose of the string and the coffee filter?
 - b. **Add the fish at the end of the lesson.**



Student's own water garden (aquatic ecosystem) completely assembled.

EXPLAIN: Students will put their water gardens aside and complete their hypothesis of how they think the water garden works. Students will turn to their table partner and they will explain their ideas to each other.

ELABORATE: Students will then share out their hypotheses about how the water garden works. I will write all the hypotheses shared on the board, noting if we have multiple similar ones. I will continue to ask students to explain their reasoning behind their hypothesis.

I will clarify the small details about nitrates in the water helping the plants.

Supporting students during elaboration: *What evidence do you have to support your hypothesis? How do you think the pump in the tank is represented in your water garden? How are the water gardens representing an ecosystem? How are the plants getting water? How does the water where the fish live stay clean? How does the water in the aquarium stay clean?*

EVALUATE: Students will finish by drawing a model of their own water gardens and labeling the parts and drawing arrows to show the movement of matter and water through the garden. Students must write why

they won't need to water their plants on top. Students also must explain 2 similarities and 1 difference between their water garden and the class's water garden.

Supporting students during evaluation: *Why don't you need to water your plant? Why do you need to feed your fish? How does your water garden represent an ecosystem? How is your water garden similar to the aquarium tanks?*

New Vocabulary:

Water garden, interdependence, aquatic ecosystem, nutrients

Safety Considerations: Don't have students cut the plastic bottles themselves.

Sources

Author: Layers of Learning (2018, January 13). Pop Bottle Ecosystem. Retrieved July 20, 2018, from <https://layers-of-learning.com/pop-bottle-ecosystem/>

[Free School]. (2016, August 15). *Understanding Ecosystems for Kids: Producers, Consumers, Decomposers.* [Videi File]. Retrieved from: <https://www.youtube.com/watch?v=bJEToQ49Yjc>

Supporting Materials:

Student Instructional Worksheet

Student Take-Home Instruction Sheet

Name: _____ Date: _____

Guiding Question:

Hypothesis:

Evidence to prove/disprove my hypothesis:

-
-
-

Describe how the water gardens are **aquatic ecosystems**.

ASSESSMENT: Draw a model of your water garden and the movement of mater through it. Make sure to label your model as well as use arrows to show the movement of water and nutrients.

Explain 2 similarities and 1 difference between your water garden and the class's water garden.

My Very Own Water Garden!

Today students created their own water garden at school! It is an example of an aquatic ecosystem. Ask your child to explain what an ecosystem is!

Here is how to take care of it at home:

- The water from the bottom will water the plants, so you don't have to water them yourself!*
 - You will have to occasionally change the fish's water, make sure that the water is room temperature before you introduce the fish back to it.*
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