Ecosystems STEM Design Challenge 2012

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Instructor Directions & Resources

Overview and Objectives

Science, technology, engineering, and math are integrate parts of a child's education. To help students meld these skills together, the ESD-STEM group has designed a STEM challenge for your students to complete during their Ecosystems Kit.

During the challenge the students will:

- Understand how living organisms (plants and animals) depend on one another for survival (4-5 LS2A)
- Understand the role of nonliving parts of an ecosystem (light, water, soil, oxygen) (4-5 LS2A)
- Understand that systems have inputs and outputs (4-5 SYSC)
- Create a diagramed model of a system (4-5 INQF)
- Understand that plants and animal have structures and behaviors that respond to internal needs (4-5 LS2D)
- Understand that nutrition is essential to health (4-5 LS1E)
- Understand how ecosystems can change slowly or rapidly (4-5 LS2D)
- Communicate their results (4-5 INQH)

Following lessons 3, 4, 6, and 11, you will give your students "letters" from Battelle Science Resource Center (BSRC)(attached). These "letters" ask the students to complete a research activity on the organisms in this kit and record their findings. The students will keep their research for a culminating activity following any time after Lesson 11. The activity calls for the students to design a technical drawing of a sustainable habitat for one of the organisms appropriate for the BSRC to construct and place within their facility. You may

adapt this assignment to fit your students. i.e. give the challenge assignment to individuals, pairs or groups.

Materials

Internet

Various books on isopods, crickets, pond snails, guppies, elodea, duckweed, and algae

Graph paper

Colored pencils

Rulers

Websites: www.pbskids.org/fetch/games/habitats/drawing.html

www.kiddyhouse.com/snails/snail.html

www.ehow.com

Rubric for final assessment

Procedure

1. Have students (individually, in pairs or groups [2 students working together on one requirement lends support for one another]) research one or more of the organisms following lessons 3,4, and 6.
2. Students record information in their science notebooks using the Design Challenge Template following the guidelines in their "letter."
3. Following lesson 11 or later, students will use the information they have gathered to design (on graph paper) a habitat for their living organism that will meet the requirements of "letter 5."
4. Review with the class the organisms nutrient needs. Will they need to provide additional nutrients to assure health and vitality in the habitat? Either assign this concept as additional research or discuss and explore as a class.

5. Consider having students develop a habitat that will provide enough of one of the living organisms for their classroom and then enough for the 50 fifth grade classrooms served by the BSRC.
6. Keep in mind complications that may develop with death or overpopulation.
7. Assess students' final project by using the attached rubric or by developing one to meet the needs of your students.

SCORE	
4	• All four requirements have complete information • Diagram is detailed with all requirements and labels • Labels show evidence of ecosystem vocabulary • Accurate drawings, neat • Correct spelling • Mathematical evidence of temperature/size of habitat/time
3	• All four requirements have adequate information • Diagram has requirements and labels • Labels show some ecosystem vocabulary • Accurate drawings, neat • Some errors in spelling • Mathematical evidence of temperature/size of habitat/time with some minor errors
2	• Requirements have minimal/missing information • Diagram is minimal or has missing information and labels • Labels little evidence of ecosystem vocabulary • Drawing is difficult to read • Many misspellings • Nearly no mathematical evidence of temperature/size of habitat/time
1	• Requirements have no information • No diagram, requirements, or labels • Labels show no evidence of ecosystem vocabulary • Drawings do not exist or are incomprehensible • Spelling is inaccurate • No mathematical evidence of temperature/size of habitat/time

TO:
FROM: Battelle Science Resource Center
SUBJECT: Live Material Sustainability

The Battelle Science Resource Center (BSRC) desires to continue to serve our schools with quality live plants and animals for the STC Ecosystems kit. However, due to rising costs, the BSRC is seeking solutions to the expense of purchasing and shipping animals and plants to classrooms studying Ecosystems.

We are asking your classroom to help us by becoming environmental engineers. We want you to design habitats the BSRC might be able to build and thus sustain plant and animal growth at our facility for replenishment of the kits.

As your class studies Ecosystems, we will be asking you to conduct research on the plants and animals.

Keep in mind the following questions:

- What type of conditions do the living organisms need to live in to survive and reproduce successfully?
- What will be required for maintaining the habitat? (type of container, food, shelter, temperature)
- What are the life cycle expectations for the organisms?

At the time of each organism study, we will check in and give you guidelines for your investigation. Your help is desperately needed. We will be looking forward to your ideas in the coming weeks!

Sincerely,

Battelle Science Resource Center

Letter of introduction as the students begin the Ecosystems Kit.

TO:
FROM: Battelle Science Resource Center
SUBJECT: Elodea, Duckweed, Algae

Your ecocolumns are now built and you've just read about your aquatic plants. Don't they look beautiful in the aquarium? Now it is time for some investigation on these organisms. Please conduct research on the perfect habitat for each aquatic plant: elodea, duckweed, and algae.

Please consider the following requirements for these plants to grow and reproduce in an indoor facility:

- Container size
- Temperature
- Light sources
- Pumps and filtration
- Plant's life cycle

Use the attached record sheet to record your findings and keep them it your science notebook. Best of luck with your endeavor!

Sincerely,

Battelle Science Resource Center

TO:
FROM: Battelle Science Resource Center
SUBJECT: Pond Snails and Guppies

Everything is growing well in the aquarium. Now it's time to add your snails and fish. Remember, we would like to grow these snails and fish at our facility to help reduce the cost of the science kits as well as provide better quality animals. Again, please investigate pond snails and guppies. What requirements would they demand to live, grow and reproduce in a habitat at our facility?

Here are some factors to consider:

- Container size
- Pumps and filtration
- Temperature
- Oxygen source
- Food requirements
- Life cycle habits

Keep all records in your science notebook. Keep a detailed list of your findings.

Sincerely,

Battelle Science Resource Center

TO:
FROM: Battelle Science Resource Center
SUBJECT: Crickets and Isopods

Look at your terrarium! The plants have grown to an amazing height! You have just finished reading about crickets and isopods and added them to your system. It's now time to research deeper into their specific needs. Conduct further investigation:

What will the BSRC need to sustain and reproduce crickets and isopods for the science kits?

- Required habitats, including space
- Light
- Pumps and filtration
- Temperature
- Food and water sources
- Life cycle expectations

Keep detailed records in your science notebook of your findings for the further designing of the habitats.

Sincerely,

Battelle Science Resource Center

Following Lesson 6

TO:
FROM: Battelle Science Resource Center
SUBJECT: Design Challenge

This ecosystem study is amazing! The plants and animals are working as a system to sustain life! Now it's time for your class to help the Battelle Science Resource Center.

Using all the research you've conducted on the living organisms, design for the resource center, and habitats for each organism group. These habitats must sustain life and reproduce more organisms for 50 kits each school year.

Here is what we are looking for:

- Detailed diagrams with labels, sizes and shapes
- Requirements for food and water
- Requirements for light
- Requirements for temperature
- Circulation needs
- Oxygen
- Amount of space to support such a system

Include charts and/or graphs, detailing required maintenance for:

- Feeding times
- Watering times
- Amount of food
- Amount of water

This challenge is an enormous task, but with all the information you have collected, your plan will be complete. Once your design is finished, publish your findings with the details listed previously and write an explanation of your plan. Good luck and we can't wait to see your solution to our dilemma!

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