



Activity 1: The Virtual Greenhouse

This is the first computer-based activity in the ER curriculum. It may take some time to get the students logged into the Portal and get started on the activity. To prepare for the activity, please read this guide carefully and run the activity before you run it with students.

In this activity, students investigate “mystery” plants in a Virtual Greenhouse to learn how plants are adapted to different environments. Students will determine how leaf size is related to the amount of sunlight each type of plant needs. (For more information on the plants, please make sure to read the Mystery Plants Guide.) In addition, students are asked to interpret a simple bar graph.

Learning Goals

Big Idea 1: Basic Needs of Organisms

- Different species have different preferred conditions for growth.

Big Idea 3: Organisms and Their Environment

- An organism thrives in specific environments that match its specific needs.

The Plant Model

In this activity, your students will use the "Virtual Greenhouse" model (found on pages 3 and 5 of the activity). First, students plant one type of plant to determine where it grows best (based on the amount of sunlight in five different flower boxes). Then, they are challenged to figure out where three different varieties of plants grow best. Each plant is uniquely adapted to grow best in a certain amount of sunlight.

In the Virtual Greenhouse there are five flower boxes that each receive different amounts of light. The goal of the model is to have your students experiment by planting seeds in the flower boxes and determining where each plant type grows best. A healthy plant will grow and produce a flower. An unhealthy plant will wilt or die. (For more information on the Mystery Plants, see the separate Mystery Plant Guide.)

Note: Before running this activity with your students, you might like to talk to them about computer models. Models often allow you to study what you cannot see in real life because the object is too big (like the entire solar system) or too small (like a molecule or atom), or because of the time scale involved (milliseconds or millennia). Models are not perfect, but do represent real science if they are programmed well.



Figure 1 (left) is the model of the Virtual Greenhouse. The sun icons on the left-hand side show how much light each flower box receives. The buttons on the right control the model. Figure 2 (right) shows a model that has been run. Seeds were planted in the five flower boxes. Healthy plants grow and flower; others are brown and wilted.

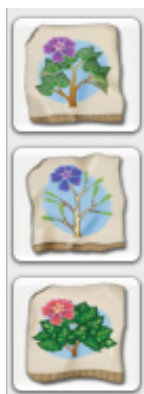
Model buttons

Make sure you run the model before your students start this activity to ensure that you are familiar with the model and the control buttons. Below are descriptions of the control buttons.

Review the use of these buttons with your students before they run the activity.



Click the Play button to start the model. Use the Pause button to stop it.

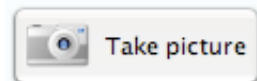


Click a seed packet icon and then click in a flower box to plant a seed of that variety. Each seed packet contains 20 seeds. (Click the Play button to start the model and the plants will grow. The bushy plants will only grow and flower in the least amount of light. The thin plants will grow best with the most sunlight. The medium plants will grow best with a medium amount of sunlight.)

Note: When students use all the seeds in a packet, the icon will grey out. Students can get more seeds by Resetting the model.



Click the Reset button to reset the model to its original condition.



Click the Take picture button to take a picture of the model. (Note: when you take a picture, the model pauses. You must click Play to restart it.) You can annotate your picture.



The Lab Book holds all pictures.



The glossary contains definitions for the vocabulary words (in blue) used in this activity. Students can click on individual blue words for pop-up definitions or click the Glossary icon for the complete glossary.



Lesson Plan

1. Estimated time

This activity should take approximately 45 minutes.

2. Introduce the activity (Engage)

If you planted the lettuce or fast plants, begin by building on students' prior knowledge of plants. Ask students:

- What do plants need to live?
- How do plants get what they need to live in nature?
- Do all plants need the same amount of sunlight?
- Do all plants need the same amount of water?



As students run the activity you may want them to keep the following discovery question in their minds. Write this question on the board so that students can see it during the class period.

How are plants adapted to live in different environments?

3. Guided inquiry (Explore)

Have students run the activity.



Refer to the stop sign symbols in the following section. Stop on those activity pages and lead a full-class discussion.

If students are working in pairs or small groups, explain to them that they should discuss their answers with classmates, and then type their answers directly into the computer.

Page 1

No questions.

Page 2

Q1. Which of the plants below grows best in the shade?

A. Hosta

Page 3

No questions.



Make sure students scroll down to see all **five** flower boxes. After students run the model, ask them: Why do you think the plants didn't grow well in some of the flower boxes?



Student pictures will vary. Plants with thin leaves (Leaf Size 1) grow to be healthy, flowering plants in the most sunlight.

Page 4

Q2. In which flower box does this Mystery Plant grow best?

A. A

Q3. What happens to plants that were planted in the other flower boxes?

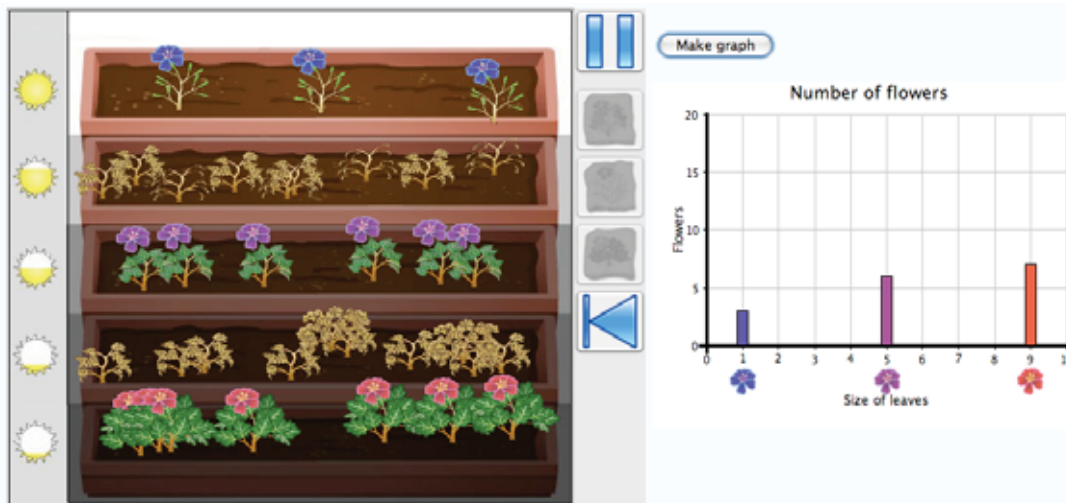
A. Some plants die (and disappear) if they are planted in the wrong flower box. If the seed was planted in a flower box adjacent to the “correct” one, it grew, but was brown and wilted. It did not produce a flower.

Page 5

No questions.



Students see a graph for the first time. Discuss bar graphs with them. Make sure students understand that the graph shows the number of healthy plants with flowers. Wilted and dead plants are not shown on the graph.



Student pictures should have flowering plants in the top, middle, and bottom flower boxes. It is likely there will be brown, wilted plants in other flower boxes. The graph corresponds to the number of healthy plants (flowers). Plants of Leaf Size 1, 5, and 9 grow in different flower boxes (top, middle, and bottom).

Page 6

Q4. In which flower box does this plant grow best?

A. E

Q5. In which flower box does this plant grow best?

A. C

Q6. What differences in the plants help them live better in certain flower boxes?

A. Student answers will vary. The plants have different size leaves, which helps them with more or less sunlight.*

* Note: The differences in leaf size allow plants to get more light in a shady environment or be protected from drying out in a sunny environment. We do not go into this level of detail with students.

Page 7

Q7. Look at the graph. Which plant type has the most flowering plants?

A. Plant Leaf Size 9

Q8. How many flowers does Plant Leaf Size 1 have?

A. 5

Page 8

Q9. Can the three plants live in the same environment?

A. No

Q10. The three Mystery Plants above need different amounts of _____?

A. sunlight

Page 9

No questions.



Wrap up the activity with the discussion below.

4. Discuss the activity (Explain)

After your students run this activity, discuss what students concluded from the activity. In particular, it is important to discuss the discovery question with your students:

How are plants adapted to live in different environments?

Below are suggestions to help guide the discussion:

Plants and their adaptations

What did you notice when you planted seeds in the model? What is different about each of the flower boxes? How does the model show the differences? What happened when you planted the seeds in different flower boxes? What can you say about each plant and the flower box where it grows best? Can you think of any plants in the real world that are adapted to their environment and would not grow well in a different environment?