# Activity 2: The Virtual Field

In this activity, students continue their exploration of the "Mystery Plants" by planting seeds in the Virtual Field. Students determine where plants grow best in the field and observe full life cycles of these plants—from seed to flowering plant, seed dispersal, and death. This activity introduces the very important concept that individuals of the same species may differ. Students examine the offspring of plants and animals and think about variation—the ways in which children are similar to and different from their parents. Students work in the Virtual Greenhouse to examine the variation in offspring of an individual plant and how variations are related to the plant's needs. Students are able to move plants to flower boxes that match their needs.

## *Learning Goals*

Learning goals highlighted in blue may be new to students as they have not been covered in prior computer activities.

*Big Idea 1: Basic Needs of Organisms*

- Different species have different preferred conditions for growth.

*Big Idea 2: Life Cycle - Birth and Death Cycle*

- Organisms are born, live, and die.
- The plant life cycle includes: seed, seedling, growing plant, flower, seedpod, seed dispersal, and death.

*Big Idea 3: Organisms and Their Environment*

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

*Big Idea 7: Intraspecific Differences*

- Individuals of the same species may differ.
- Not all offspring from the same parents look alike, even with respect to inherited traits.
- Students should demonstrate an understanding of the process of breeding: that purposeful selection of certain traits over many generations can result in substantial changes in the physical characteristics of organisms in a population.

*Big Idea 9: Heritability of Traits*

- Offspring inherit some, but not all, of their traits from their parents.
- There is a difference between traits that are inherited and traits that are not.

*Big Idea 10: Reproduction*

- Organisms have offspring.

## *The Models*

In this activity, your students will use a model of the "Virtual Field" (found on page 2). The field model is similar to the “Virtual Greenhouse” model your students used in Activity 1. The goal of the model is to have students experiment by planting seeds in the different rows—which correspond to different light levels—and figuring out where each plant type grows best. Remember, sunlight is one part of a plant’s environment and each type of mystery plant thrives only under a specific amount of sunlight.

The field has ten rows, representing ten light levels. Each type of plant grows best under only one light level. This model also shows that plants can grow in nearby environments, but are not as healthy (they are seen below as wilted, with no flowers, and a brown color). If a seed is planted in a row directly adjacent to the plant’s preferred environment for growth, it will grow, but be unhealthy and not flower. If a seed is planted in a row more than one sunlight level away from the preferred environment, it will not grow at all.

Please note that the low light levels in the field are at the TOP of the field whereas in the Virtual Greenhouse, the flower box with the least amount of sunlight was on the bottom. Students should look at the amount of light, as represented by the sun icon, not relative top/bottom placement in any particular model environment.

There is also a graph to the right of the model. This graph displays the number of healthy plants, which are the plants that grew a flower. This graph changes after each growing season.

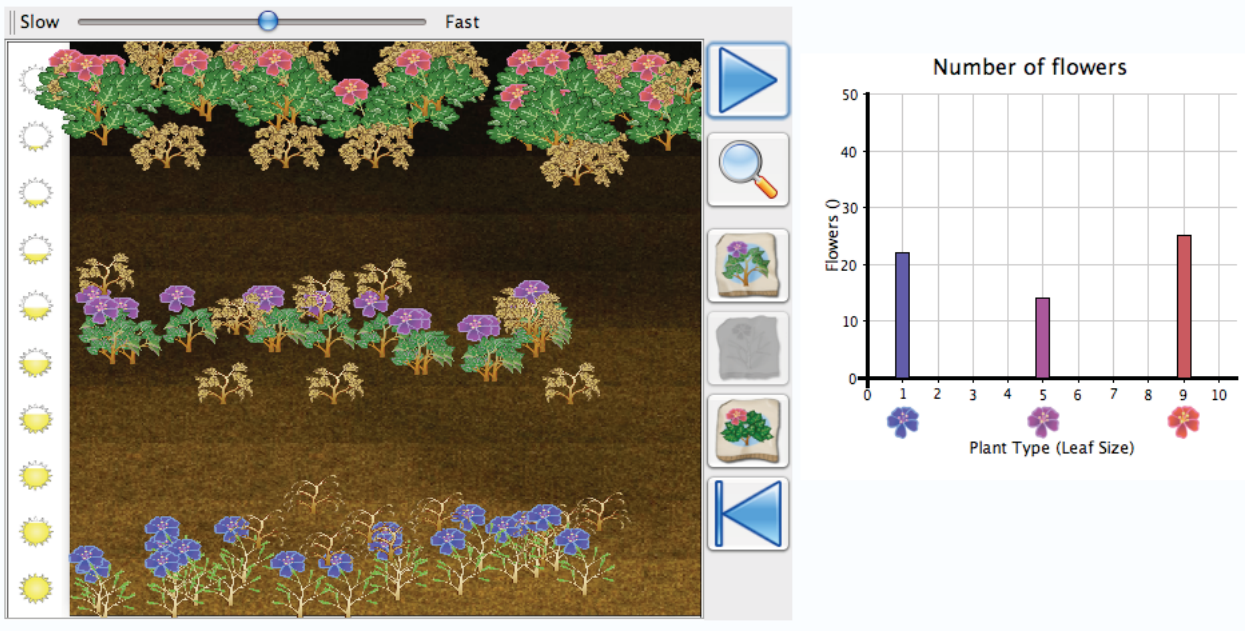



*Figure 1 (left) is the Virtual Field. The sun icons on the left-hand side show how much light each row of the field gets. The buttons on the right control the model. Figure 1 (right) shows a graph of the healthy*

*(flowering) plants of each leaf size—in this case, Leaf Sizes 1, 5, and 9.* The controls on the right side of the model work the same way they did for the Virtual Greenhouse model in Activity 1.

On page 7 there is a model of three flower boxes. The flowers in this model produce offspring that vary from the parents. This is a new feature of the model. This means that offspring may not all be suited to the flower box they are found in. Make sure your students observe the differences by clicking on the Information Tool  and then clicking on each of the plants.

*Figure 2. Flower box model. Note: students must wait several seconds after the first flowering plant drops its seeds before the new generation of plants begins to grow. Pop-up messages tell students what to notice and to do.*

This model has a new Carry button,  .

Students can click the Carry button and then click on any plant in the model to carry it to a new location. Have students hold the mouse down as they drag the plant to a different flower box (the roots will be visible now!). When they let go of the mouse, the plant will be planted in a new location. Note: if students try to plant between flower boxes, their plant will go back to its original location.

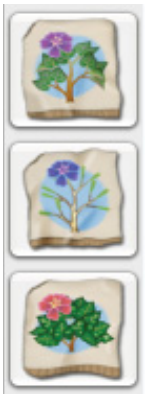
## *Model buttons*

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 the Information Tool and then click on a plant in the model for information about the plant.**

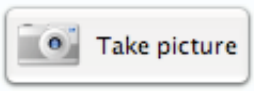


**Click a seed packet icon and then click in the field to plant a seed of that variety. Each seed packet contains 20 seeds. (Click the Play button to start the model and the plants will grow. The bushy plants will only grow and flower in the least amount of light. The thin plants will grow best with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

**The Carry button allows students to pick up a plant and move it to a different location. Students should notice the root size and shape for each plant when they move plants from one box to another.**

**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)*

Lead a brief class discussion before running the activity.

Have students think about the plants in Activity 1.

- Which plants grew in the shady flower box?
- Which plant grew in the sunny flower box?
- What would happen if you planted a plant that likes a lot of shade in an area that is shady, but not quite shady enough for that plant? Why?

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.

*What does variation mean?*

## *3. Guided inquiry (Explore)*

Have students run the activity.

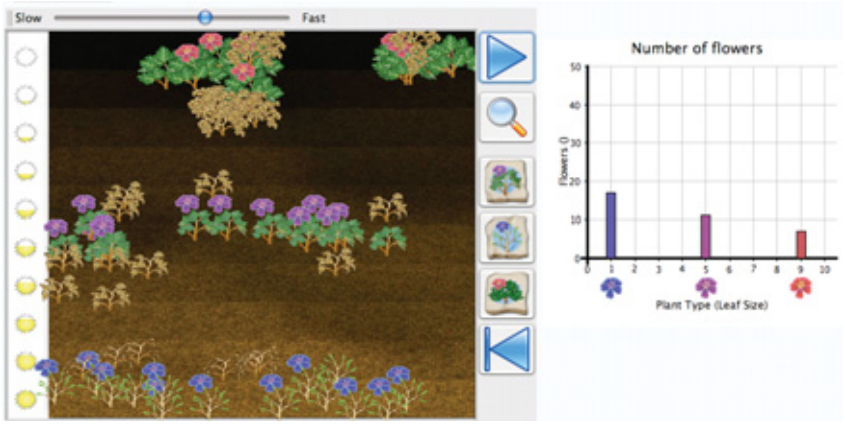
Refer to the stop sign symbols 

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**
*No questions.*




*Student pictures and notes will vary. The flowering plants are greener than the plants that are not flowering. The plants that are flowering are in the row that has the best amount of light for that plant.*


Did all students succeed in finding where to plant the seeds so that flowering plants would grow? Ask students to describe their strategies for planting the seeds.

**Page 3**

Q1. Describe the life cycle of the Mystery Plants in the field.
A. The Mystery Plant starts as a seed, then grows into a seedling, then an adult plant. It flowers and produces new seeds.

Q2. What happens to the parent plant during the winter?
A. The parent plant dies but its offspring grow in the spring.

**Page 4**

Q3. What kind of leaves do Leaf Size 1 plants have?
A. Small, skinny leaves.

Q4. Where in the field did the Leaf Size 9 plants grow best?
A. In the shady part of the field.

Q5. Is the purple flower on the Leaf Size 5 plant an example of an inherited trait? Why or why not?
A. Flower color is an example of an inherited trait because it is passed down from parent to offspring.

**Page 5**

Q6. Describe some of the ways these puppies are different from one another.
A. Student responses will vary. Students may comment on fur color, for instance.

**Page 6**
*No questions.*

**Page 7**
*No questions.*

*Student pictures should show a total of six flowering plants – four in the middle flower box and one each on the top and bottom flower boxes.*


Be sure that students click the Information Tool  to learn more about each plant. The differences are small, but important. Ask students about the offspring plants. (Answer: There are four Leaf Size 5 plants, 1 Leaf Size 4, and 1 Leaf Size 6.)

**Page 8**

Q7. Check your Lab Book to see the picture of your last experiment in the Virtual Lab. Were all the Mystery Plant offspring the same as their parents?
A. No.

Q8. How were some of the offspring Mystery Plants different than their parents?
A. Some of the offspring were different leaf sizes than the parents. The parent plant was Leaf Size 5 and most offspring were also Leaf Size 5, but one was a Leaf Size 4, and one was a Leaf Size 6.


Wrap up the activity with the discussion below.

## *4. Discuss the activity (Explain)*

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

*What does variation mean?*

In addition, you might like to discuss:

- Generations
- Adaptation

Below are suggestions to help guide the discussion:

### *Variations in plants and animals*

Look at the puppy poster. How are the puppies the same as their parents and how are they different?

Give examples of other animals and their variations.

How does the plant model show that baby plants are different from their parents?

### *Generations*

Describe the life cycle of a plant (page 3).

How does the model on page 2 show generations of plants?

Are there new plants growing each year in the model or are they the same plants? It is very important that students understand that the plants growing in one season are the offspring of the prior season's plants.

### *Adaptation*

How do differences in the plants affect where they can grow?

What are some other real-world examples where adaptations help plants or animals survive in their environment?