A-Mazing Plants

Strand	Ecosystems	
Topic	Investigating phototropism	
Primary SOL	LS.10	The student will investigate and understand that ecosystems, communities, populations, and organisms are dynamic, change over time, and respond to daily, seasonal, and long-term changes in their environment. Key concepts include a) phototropism, hibernation, and dormancy.
Related SOL	LS.3	The student will investigate and understand that living things show patterns of cellular organization. Key concepts include b) patterns of cellular organization and their relationship to life processes in living things.

Background Information

Tropism is a change in direction of a plant's growth in response to an external stimulus. The stimulus could be weather, touch, time, gravity, or light. A positive response is indicated by growth toward a stimulus and a negative response is indicated by growth away from the stimulus. Phototropism is a directional change in response to a light source.

There are many experiments that can be conducted to test the needs of plants. Students may test the effects of varying factors such as light source, light intensity, soil type, water amounts and ingredients, and fertilizer. These experiments provide data suitable for making continuous line graphs. In this activity, students need to be aware of the needs of plants and take steps to keep food, water, nutrients, and ambient light levels constant when conducting experiments on phototropism. Students will measure plant growth as the plant grows toward a light opening in a box or a box with a maze inside, as compared to control plants grown outside a box.

Materials

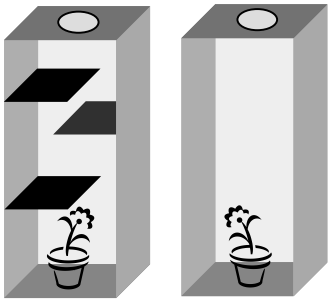
- Seedlings of a fast growing plant, such as beans or sunflowers
- Soil
- Small pots or cups
- Rectangular boxes (half-gallon milk containers or shoe boxes with lids work well)
- Cardboard
- Tape
- Scissors
- Black paint
- Rulers
- Graph paper
- Copies of "The Effect of a Maze on Phototropism" (attached)

Vocabulary

phototropism, response, stimulus

Student/Teacher Actions (what students and teachers should be doing to facilitate learning)

1. Review the needs of plants.
2. Ask students to brainstorm ideas of experiments that could test these factors. Discuss how plants can move; for example, roots grow toward the earth or seeds may fly in the wind or be carried by animals. Plants also grow toward their energy source. Point out examples of rapidly growing plants, such as kudzu and kelp, which can grow a foot each day. Ask students whether they have noticed how plants grow toward the light—whether they have ever turned the pots of houseplants to maintain even growth.
3. Brainstorm with students ways to test phototropism, which is the tendency of growing plant organs to move or curve under the influence of light. Suggest a maze box, and brainstorm maze patterns.
4. Obtain and pot three fast growing seedlings, making sure to maintain constant conditions for all three—e.g., the same type of plant; same type of pot (volume); same quantity of soil (mass); same quantity, kind, and temperature of water (ml or l); same air temperature.
5. Paint the inside of two boxes black.
6. Draw a circle on the end of each box, and cut out the two circles. Position the boxes vertically, as shown at right.



7. Cut pieces of cardboard about half the width of a box, and tape them inside one box to create a maze. (You can cut slits into the side of the box and insert the cardboard through them.)
8. Place the boxes in the same window or at the same distance from a light source.
9. Place a plant inside each box and a third plant near the boxes to serve as a control. Measure the height of each plant and record on a class data chart. Close the boxes.
10. Water the plants with the same quantity, kind, and temperature of water as needed. Measure the height of each plant at regular time intervals, such as at the same time every day or every two days. A ruler can be taped to the side of each box so that the plants will not be disturbed by measuring. Record all data on the class data chart, and have students complete copies of the "The Effect of a Maze on Phototropism" handout.
11. After a week or two, have students use the resulting data to make a continuous line graph with three lines, each with a different color to represent the heights of the three plants. Have students also make comments on the direction of the plants' growth.

Assessment

- **Questions**
  - Why do plants respond this way?
  - How does this experiment show phototropism?
  - How does this experiment simulate the way plants might grow in natural habitats?
- **Journal/Writing Prompts**
  - Describe how plants that grow on a forest floor are affected by phototropism.
  - Explain how seedlings are affected by growing in the shade of other plants.

Extensions and Connections (for all students)

- View time-lapsed video of examples of phototropism.
- Plant a window sill garden with fast growing plants such as sunflowers. Let the plants grow toward the sunlight coming through the window.

Strategies for Differentiation

- Explore other types of tropism:
  - Hydro
  - Chemo
  - Gravi
  - Thermo
  - Thigmo
- Break down vocabulary into prefixes and root words to help students understand the meanings (e.g., hydro, photo, trop).

The Effect of a Maze on Phototropism

Name: _____ **Date:** _____

Independent variable:

Dependent variable:

Constants:

Observations

Make a sketch of the appearance of each plant at the end of the experiment.

Control	**Plain Box**	**Maze Box**

Data

Day	Height of Control Plant	Height of Plant in Plain Box	Height of Plant in Maze Box
1			
2			
3			
4			
5			
6			
7			

Conclusion