

Grade Level: Second
Piagetian Level: Concrete

This assignment is suitable for learners with established and developing concrete operations.

STEM *Science, Technology, Engineering, & Mathematics*



Learn & Grow
Educational Series™

The Opposites of Dark and Light

Instructional Goal: Following instruction, students will demonstrate an understanding that plants require water and light to grow.

Lines of Inquiry:

- What are the differences between plants grown with water and without?
- What are the differences between plants grown with light and without?
- What are the differences between plants grown with light and water and plants grown without either?

Materials:

- Tools & materials for building out one self-watering container per student (see <http://learn-and-grow.org> for instructions & materials)
- Organic potting soil with compost or fertilizer mixed into it—enough for each container
- Enough green bean seeds to provide each student with 5 each for his/her self-watering container
- Water for each self-watering container's reservoir in the Control Group and Experimental Group A (see instructions)
- Five dark-colored, non-transparent disposable drinking cups per student in Experimental Groups B and C (see instructions)
- One standard metric school ruler (ruled in centimeters) per student

- One data collection sheet & pen/pencil per student
- Colored pencils (4 different colors) per student

Instructions:

- Prior to instruction, with additional adult support as needed, pre-cut and drill the 5-gallon buckets and PVC pipes for your students' self-watering bucket containers.
- In a whole-class discussion, ask your students to share their thoughts about whether plants need light, water, or both to live.
- Following the instructions found at <http://learn-and-grow.org>, demonstrate to your students how the parts of the self-watering containers go together and have each assemble his/her own self-watering bucket containers; each student should have his/her own self-watering bucket container.
- With additional adult support as needed, assist your students in filling the upper chambers of their self-watering bucket containers with soil.
- Have your students each plant five green bean seeds in his/her respective container.
- Divide your class into four groups of

Common Core Standards:

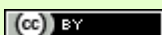
- W.2.7. Participate in shared research and writing projects.
- W.2.8. Recall information from experiences or gather information from provided sources to answer a question.
- MP.2. Reason abstractly and quantitatively.
- MP.4. Model with mathematics.
- MP.5. Use appropriate tools strategically.

CA State Standards—Science:

- 2-LS2-1. Plan and conduct an investigation to determine if plants need sunlight and water to grow.



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The Opposites of Dark and Light, continued...

students; have the students in each group mark his/her self-watering container with his/her respective group number and name (either use permanent marker on the outside of the container, make unique flags that stick up out of the soil, or have the students decorate the outsides of their reservoir buckets as an art project prior to beginning this lesson to include their names and group numbers).

- In the area designated for your class' self-watering bucket container garden, have each group arrange its containers spaced far enough apart from the other groups' to distinguish each group's collection of containers from the others.
- Have your students record the current date as the seeding date on their Data Sheet, found at the end of this lesson plan.
- Your Group 1 students' containers will be your Control Group against which *no experimental measures will be taken*. Have your Group 1 students fill the reservoirs with water and moisten the tops of the soil in the upper growing chamber of their self-watering containers.
- Your Group 2 students' containers will be Experimental Group A, in which the seeds will be *deprived of water* but not light. Your Group 2 students do not need to do anything further with their containers.
- Your Group 3 students' containers will be Experimental Group B, in which the seeds will be *deprived of light* but not water. Have your Group 3 students fill the reservoirs and moisten the soil in their self-watering bucket containers; then have them place darkly colored plastic cups over the spots where they planted their bean seeds.
- Your Group 4 students' containers will be Experimental Group C, in which the seeds are *deprived of both water and light*. Have your Group 4 students place darkly colored plastic

cups over the spots where their seeds were planted.

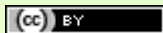
- Have your students work in their groups to monitor the development of their plants over the next 10 instructional days and record their daily data as described in the Data Sheet located at the end of this lesson plan.
- After 10 instructional days, have your students collaborate with you in class to create a bar graph of each group's data, visually showing the measured impact of each experimental condition relative to the control condition; if possible, represent it in a manner that can be seen by all your students at once, such as projecting it onto a screen or using a SmartBoard®.
- Discuss with your class the impact that water and light deprivation appears to have had, based on the data and their observations, on the development of the bean seeds.
- Have your Group 2 and Group 4 students fill the reservoirs and moisten the soil in their self-watering bucket containers; have your Group 3 and 4 students remove the darkly covered cups from their containers.
- Allow the plants to grow to harvest and have your students pick the beans produced by their plants.
- Discuss with your students as a class if they can tell any differences between the beans produced by any of the experimental groups and the control group as well as what they think may be responsible for any differences, given the differences they observed during their experiments with seeding them.



Where possible, children should be encouraged to eat the fruits and vegetables they grow in order to make the cognitive connections between growing food, where food comes from, how food provides fuel to the human body, and how healthy foods make a difference in how the mind and body feel and work. This also gives them a sense of empowerment and control over their environments that encourages their intrinsic motivation to eat healthy foods.

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Name: _____

Student Data Sheet

**Seeding
Date:**

My plants are in (check the correct box):

- ☐ The Control Group ☐ Experimental Group A
☐ Experimental Group B ☐ Experimental Group C

10-Day Data

Day	Date	Number of Sprouts	Height of tallest sprout	Height of shortest sprout
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				



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