Lesson Name: Plants and the Environment
Presenter(s): Jules Cho, Candice Cherk, and Kevin Lance
Grade Level: 2nd/3rd Standards
Connection(s): 2nd grade – Plants are affected by environment (growth, light, gravity). LT reproduce their own kind. LT respond to environment. 3rd grade – When environment changes, living things respond.

Teaser: Living things are constantly responding to their environment. That includes you and me, the animals around us, and plants! Plants are everywhere—they make the oxygen that we breathe, provide the wood for our houses and fires, and are tasty to eat! Light, water, and gravity are very important environmental factors that greatly affect how plants respond and grow. So what happens when the environment changes on a plant?

Objective: Students will learn about several plants (Bean plants, Sensitive plants, and mouse-ear cress) and how they grow and respond to three environmental conditions: gravity, drought, and light. They will learn to make hypotheses and observations, and compare their observations back to their hypotheses. After the lesson, students will be able to test these and other environmental conditions with seeds of other plants that we will provide.

Vocabulary/Definitions: 3 – 6 important (new) words
Light
Gravity
Drought
Hypothesis

Materials:
What will you bring with you?
- Plants: 2 Blue Lake Bean plants (Family: Fabaceae / Scientific: Phaseolus vulgaris )
  1 plant will be subjected to a change in gravity for a prolonged period of time.
  2 Sensitive plants (Family: Fabaceae/ Scientific: Mimosa pudica)
  1 plant will be subjected to touch and light to see how it responds.
  2 Mouse ear cress plants (Family: Brassicaceae/ Scientific: Arabidopsis thaliana)
  1 plant will not be watered for a prolonged period of time.
- Handouts—“Lab Notebook”
- Seeds
- Clear plastic cups
- Paper towels

What should students have ready (pencils, paper, scissors)?
- Pencil
**Classroom Set-up:** Student grouping, Power/Water, A/V, Light/Dark, set-up/clean-up time needed
- Chalkboard or whiteboard
- Chalk or dry erase marker
- 3 student groups
- 3 stations (3 groups of desks or 3 large tables)

---

**Classroom Visit**

1. **Personal Introduction:** ___3____ Minutes

   *Who are you? What do you want to share with students and why? How will you connect this with students’ interests and experiences?*

   My name is Kevin and I study bioengineering, which means I use biology to create new technology. My job is to invent new ways that doctors use drugs to cure diseases. When I’m not working I also like to go running and play sports like football and basketball. As a part of studying biology, I also like to experiment with plants.

   My name is Candice and I study plant disease. Just like us, plants can get sick, too. In the lab, I do experiments to learn about how they get sick. Outside the lab, I like to try new restaurants and play with my dog.

   My name is Jules, and I also study plant disease. I try to figure out why some plants get more sick than others in the lab-I study bean plants. When I’m not at work, I like to go hiking and camping as much as possible because I really like being outdoors.

   We work in laboratories and have to come up with Hypotheses [write vocabulary word on board] all the time. Hypothesis is a fancy scientific word for a guess or prediction. We try to think of possible ways to explain observations that we have made, in our case, about plants. We think plants are awesome and want people to learn more about them. We see plants every day when we walk outside or when we go to the grocery store, but most people don’t think about how they grow.

   Have you ever thought about how plants grow?

---

**Topic Introduction:** ___7____ Minutes

*What questions will you ask to learn from students? Big Idea(s), vocabulary, assessing prior knowledge…*

   Living things are constantly responding to their environment. That includes you and me, the animals around us, and plants! Plants are everywhere—they make the oxygen that we breathe, provide the wood for our houses and fires, and are tasty to eat! And just like us, they respond when their environment changes! For example, when we get hot, what can we do to cool
down? [call on a couple students -drink water, sit under shade, turn on the fan] We can change our local environment or surroundings. So what do plants do? Well, they certainly can’t walk! So they have to deal with things a little differently, as we will all soon find out.

Gravity, Light and Drought [write these vocabulary words on the board] are very important environmental factors that greatly affect how plants respond and grow. Gravity affects everyone and everything, and it is the force that keeps us with our feet on the ground. Without it, we would float away into outer space! Plants use gravity to tell how to grow with their leaves upwards and their roots downwards. Plants need light in order to grow big because light provides plants with energy to make food. Drought is a fancy word for when water is not available. This is important because plants also need water to live and grow, just like us! Today we will look at how these environmental changes affect a plant.

So anyone recognize any of these plants? [hold up normal plants] You might recognize this one in 6 weeks because many of you have probably eaten something from it. How many of you have eaten beans? Well, this is a bean plant. We also have a special fern-like plant sometimes called “The Sensitive Plant”. And this plant is called mouse-ear cress because the leaves look like little mouse ears. It is the most well studied plant of all plants, and it is actually considered a weed! Now let’s go make some hypotheses about how gravity, light, and drought affect these plants!

2. Learning Experience(s):
   ___30____ Minutes
   What will you do, what will kids do? Demonstrations, hands-on activities, images, games, discussion, writing, measuring... Describe in order, including instructions to kids.

   Students will be divided into three groups and each group will go to a different station. Each station will focus on a different environmental effect and be showcased by a different type of plant. The students will fill in the top of their lab notebook with the new vocabulary word and will make a hypothesis about what the plant will look like depending on each condition.

   **Station 1: Touch/Light, Mimosa pudica (Kevin)**
   Students will be introduced to the idea that some special plants can respond rapidly to their environment. They will observe a Mimosa in its native, unfolded state, then they will be able to touch it so that its leaves fold up. A lamp will be brought to help show that Mimosa unfold in the presence of light. They will talk about how it could possibly do this, and why that might be an advantage for the plant. As the plant unfolds again, they will compare and contrast their observations about the Mimosa with other plants that they’re familiar with (i.e. grasses behavior when dry and with sunlight).

   **Station 2: Gravity, Blue Lake Bean (Jules)**
   Students will be introduced to the importance of gravity for plant growth. They will observe a normal bean plant grown upright in its pot and then hypothesize on what it will look when its pot was tipped over to its side and draw it in their notebooks. Then they will observe a plant
grown on its side and draw it in their notebooks. Finally, they will compare the differences between their observations, their hypotheses, and the control/normal plant.

Station 3: Water/Drought, Arabidopsis (Candice)
Students will be introduced to the importance of water for plant growth. They will observe a normal Arabidopsis plant grown with water and then hypothesize about what a plant would look like when no water is added and draw it in their notebooks. Then they will observe an unwatered plant and draw it in their notebooks. Finally, they will compare the differences between their observations, their hypotheses, and the control/normal plant.

3. Wrap-up: Sharing Experiences
   ____10____ Minutes
   Putting the pieces together – how will students share learning, interpret experience, build vocabulary?

   What are three environmental conditions that are important for plant growth? Why is light important? Why is gravity important? Why is water important? (Some examples of exceptions here.) What if you tried to grow a plant in a space ship?
   Can you name other environmental factors that could affect plant growth (temperature, elevation, pH, wind, etc)?

4. Connections & Close:
   ____5____ Minutes
   What else might kids relate this to from their real-life experience? How can they learn more?
   Clean-up.
   Next time you go on a walk, take a look around you. There are plants everywhere. What do the plants under trees look like compared to plants that are not shaded? How do the flowers on the mountain look compared to the ones at the beach? If you decide to plant a vegetable garden, what kinds of things can you do to the environment to let the plants grow bigger? We will be giving you seeds to grow, and it would be great for all of you to come up with some experiments to see what happens to the plants when you change their environment. Thanks and good-bye!

Total 50 – 60 Minutes
Follow-up – After Presentation

Suggest students write a letter explaining “How we learned about?”
List or attach examples of activities, websites, connections for additional learning.
Attach worksheets, hand-outs, visuals used in classroom presentation.

If students are interested in seeing more videos about plant motion,

Effects of light and gravity on plants:
http://plantsinmotion.bio.indiana.edu/plantmotion/movements/tropism/tropisms.html
http://plantsinmotion.bio.indiana.edu/plantmotion/earlygrowth/photomorph/photomorph.html

More on growing plants in the classroom:
http://www.ehow.com/how_2247288_grow-plants-classroom.html

From the Ground Up (4-H Plant Science Lesson) – Conduct 4 activities to observe how plants respond to light and gravity. Learners record their observations on a data table for five days to note changes in plant growth under different conditions. This activity can be used to introduce learners to seed germination and plants as well as the scientific process.
http://4h.uwex.edu/pubs/showdoc.cfm?documentid=33867

Reading Connections:
- Science with Plants (Science Activities) by Mike Unwin http://www.amazon.com/Science-Plants-Activities-Mike-Unwin/dp/0746009763