Plant Growth STEM Experiment

Overview:

This lesson uses the micro:bit to measure the level of moisture in the soil through changes in conductivity. It is meant to build on early elementary experiments determining the effects of water and sunlight on plant growth.

Students have already:

- Used observations to describe patterns of what plants need to survive. (NGSS K-LS1-1)
- Planned and conducted an investigation to determine in plants need water and sunlight to grow. (NGSS 2-LS2-1)

Students will be able to:

- Construct a circuit to act as a conductivity meter.
- Utilize simple block code to produce a device that will measure and read out conductivity values.
- Construct a data table and graph to observe a trend
- Make a conclusion based on the data
- Use the data and conclusions to support an argument that plants need water to grow. (NGSS 5-LS-1-1)

Materials needed:

- 5 Micro:bit devices with USB cable
- 15 wires with croc clips
- 10 metal rods for electrodes (silverware works well)
- 5 battery packs
- 5 cups
- 1 bag of potting soil
- 1 packet of fast-sprouting seeds (lima beans, basil, lettuce etc.)
- 1 liter of water

Recommended Procedure:

1. Place potting soil in each cup to the same level.

2. Place the seeds in the soil evenly spaced apart. Vary the # of seeds in each cup systematically.

Cup #	# of Seeds
1	0
2	2
3	4
4	6
5	8

3. Place 1 inch of soil over the top of the seeds and add an equivalent amount of water to each cup. (The soil should be moist but not water-logged)

4. Place the cups in the same place in the class room where they are exposed to an equal amount of sunlight.

5. Download the code from the micro:bit website onto each of the 5 micro:bits and connect the battery pack to each micro:bit.

6. Place a pair of metal electrodes into each cup. Make sure to space the metal electrodes equally for each up.

7. Connect each micro:bit to the metal electrodes in each cup and test to make sure that they read the same reading (smiley face). If they do not read the same level, then re-adjust the position of electrodes until they do.

8. 3 times each day, record the conductivity level of each micro:bit and place into a table. Example table below.

Date and Time	Cup #1 Conductivity Level	Cup #2 Conductivity Level	Cup #3 Conductivity Level	Cup #4 Conductivity Level	Cup #5 Conductivity Level
June 6th 9am					
June 6th 12pm					

9. After the table is completed, have the students make a scatter plot graph on a piece of graph paper.

Recommended Discussion Questions

- How does the number of seeds affect the moisture levels in the soil over time?
- What trends do we see in our graph? Is the trend clear? Why or why not?
- What explanation can you develop that would explain the observed trend?

Standards Addressed

Support an argument that plants get the material they need for growth chiefly from air and water. (NGSS 5-LS-1-1)

Crosscutting Concepts

- Patterns in the natural and human designed world can be observed and used as evidence. (NGSS)
- Events have causes that generate observable patterns. (NGSS)
- Matter is transported into, out of and within systems. (NGSS)

K-12 Computer Science Concepts & Practices

Concepts	Practices
• 5-8. *Computing Systems*. Devices • 5-8. *Computing Systems*. Hardware and Software • 5-8. *Computing Systems*. Troubleshooting • 5. *Data and Analysis*. Collection • 5. *Data and Analysis*. Visualization and Transformation. • 5. *Data and Analysis.* Inference and Models. • 5-8. *Algorithms and Programming*. Algorithms • 5-8. *Algorithms and Programming*. Variables • 5. *Algorithms and Programming*. Control • 5. *Algorithms and Programming*. Program Development	• P1. *Fostering an Inclusive Computing Culture*. 1, 3 • P2. *Collaborating Around Computing*. 1-4 • P4. *Developing and Using Abstraction*. 2, 4 • P5. *Creating Computational Artifacts*. 1, 3 • P6. *Testing and Refining Computational Artifacts*. 3 • P7. *Communicating About Computing*. 1-2

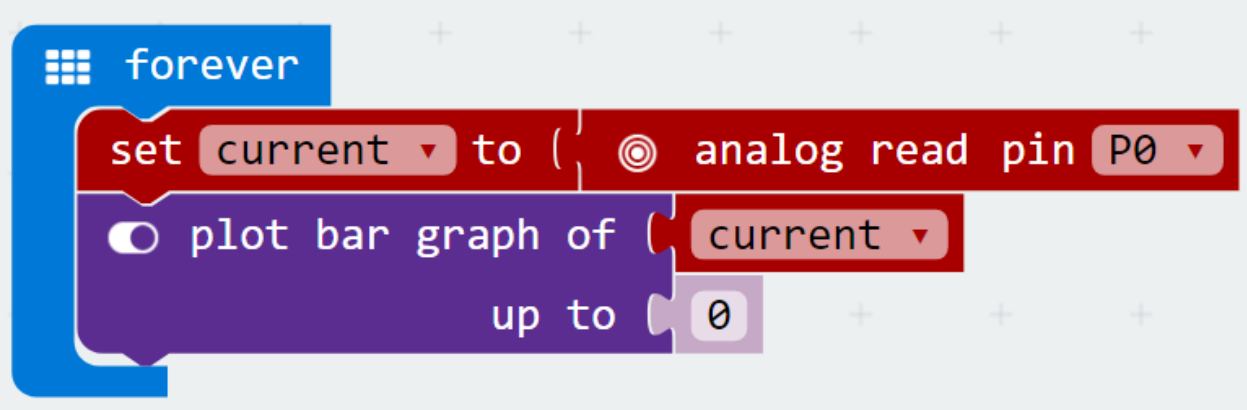
NGSS Standard

Use observations to describe patterns of what plants and animals (including humans) need to survive. **K-LS1-1 Grade level: K-2**
Plan and conduct an investigation to determine if plants need water and sunlight to grow. **2-LS2-1 Grade level: K-2**
Support an argument that plants get the materials they need for growth chiefly from air and water. **5-LS-1-1 Grade level: 3-5**

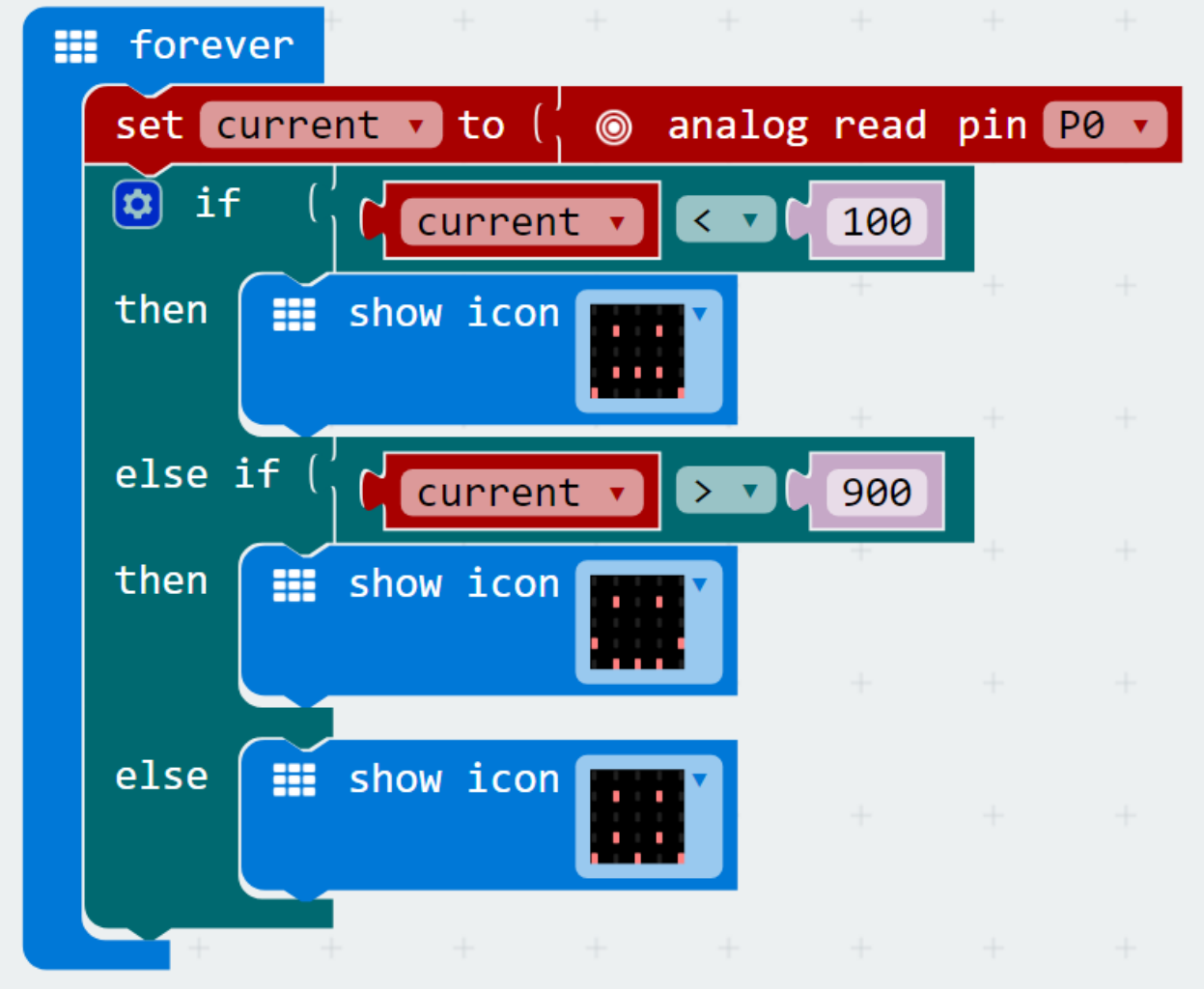
Make Code: Experiments

See: https://makecode.microbit.org/projects and scroll to STEM

Experiment 1: Blocks Measure Current (Display Current)



Experiment 2: Blocks Measure Current (Show Icon)



Make Code: Challenges

- Try different numbers/ types of seeds (ones that generate a lot of roots vs. little roots (to show link between amount of roots and water uptake)
- Try different environments (high sunlight vs. low sunlight) to show link between photosynthesis and water uptake
- Modify micro:bit soil variable number to give more quantitative data.
    - Modify the changes to the soil effect with the inequality on button B pressed. Then add a third conditional statement to have three different expressions from the plant to the micro:bit.