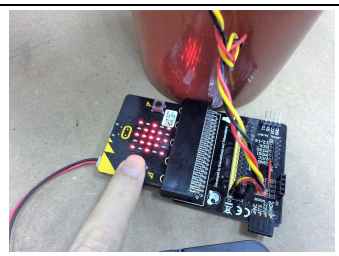
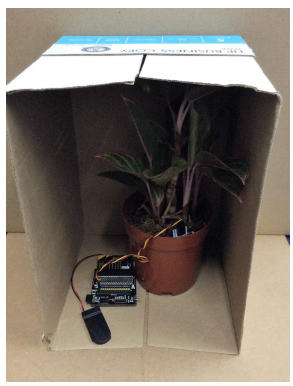
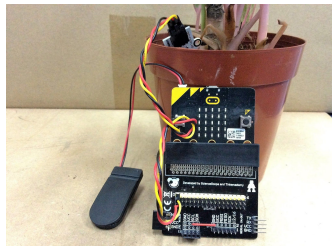
Plant Growth and Care with the micro:bit

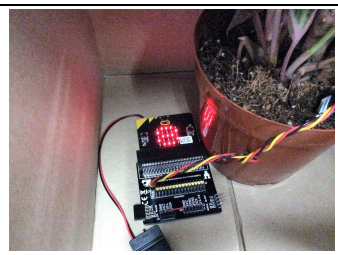
Subject: Science
Level: Primary 5 / 6
Unit: Energy Forms and Uses
Topic: Photosynthesis

Summary:
Students will set up experiments to record plant growth / health in the classroom while measuring different variables such as light and water. This allows them to observe the effects of photosynthesis in a tangible way.

Prior Knowledge:	Basic understanding of what plants need to grow (water, sunlight) Basic understanding of photosynthesis (plants convert light to stored energy)
Objectives:	Plants require light to grow Different levels of light will affect the growth of a plant Conduct a fair experiment with a control
Resources:	micro:bit with battery pack and USB connector and breakout board 2 identical potted plants Recycled cardboard box

Step	Teacher Activities	Purpose & Pictures	Resources Needed
Introduction/Pre-activity			
Step 1	Recap with students our energy sources, a plant's energy sources and conditions for growth carbon dioxide + water (+ light + chlorophyll) ⟶ oxygen + sugar		
Step 2	Discuss fair experiments and the need for a control and regular measuring. Discuss with the class about the variables that should be constant in the control.	Reiterate importance of consistency in scientific experiments.	
Step 3	Introduce the class to the micro:bit with the moisture sensor attached. Explain (and show if desired) that the micro:bit's have been programmed to continuously sense the moisture in the soil and the light hitting the face of the micro:bit.	 Sun icon appearing	- Soil Moisture Sensor x2 - micro:bit x2 -breakout board x2 - microbit code press A for light press B for soil M - Connect Moisture Sensor to Pin 0 microbit-Plant-Car

	Demonstrate light sensor by - Pressing Button A without covering the LED matrix on the front. The reading will vary but should not be below 50. Then press Button B with your hand covering the matrix and remove your hand when the sun icon appears to read the value. It should be less than 50. Demonstrate soil sensor by - Pressing Button B and reading the value without touching the soil sensor, or placing it in any soil. (should be a low value, 0 - 20) Then insert the soil sensor fork prongs down into the soil and press Button B again. The reading should be much higher (100 to 900)		e---Fair-Test.hex - http://tk.sg/mbit-plantmonitoring
Lesson development/Main activities			
Step 4	Measure the two potted plants so as to chart their growth. Set both pots up in the classroom where there is sufficient sunlight. Cover one with the recycled cardboard box. (Variations of this step could be that the cardboard box has holes)	Set up the experiment as fairly as possible (same location, same temperature etc, only varying the light levels) 	Cardboard box
Step 5	Insert the soil moisture sensor into the soil and position the microbit to face the sun.		

Step 6	Use the micro:bit to measure the light and moisture levels at the start of the experiment. Press A to read the light level. Press B to read the soil moisture level.	 light level under the cardboard box	
Step 7	Regularly measure the growth, light and moisture level for both plants. Chart these measurements as a class. Make sure that the soil moisture levels stay the same. The class could have a class roster to rotate measuring and watering duties between groups.	Regular measurements help to ensure the fairness of the test, and alerts plant caretakers to any low levels of water etc. Ensure the students take responsibility for the care of the plants.	Mahjong Paper / Charting material
Step 7B	If the microbit shows 255 as a value, wipe the back with a cloth and press the reset button at the back.	 Back of the micro:bit	
Step 8	After 3-4 weeks, measure the plants for the final time. Compare the growth of the plants. Additional activities suggested in remarks below.	Illustrate the effect a lack of light will have on plants.	
Closure and consolidation/Post-activity			
Step 9	Link back to the larger topic of energy sources and get students to think about the amount of land with access to light is required for industrial farming. And what happens when farming goes vertical (requires artificial light)		Photos/videos to industrial farming and vertical farms
Step 10	DIscuss what to do with the plants as a class.	Ensure that students take responsibility of their work till the end. Whether it is ensuring the plant finds a home or is actively taken care of by the entire class.	

Attachments:

Micro:bit code

```
let Moisture = 0
let light = 0
input.onButtonPressed(Button.A, () => {
    light = input.lightLevel()
    basic.showLeds(`
        . . . . .
        . . . . .
        . . # . .
        . . . . .
        . . . . .
        `)
    basic.pause(100)
    basic.showLeds(`
        . . . . .
        . # . # .
        . . # . .
        . # . # .
        . . . . .
        `)
    basic.pause(100)
    basic.showLeds(`
        # . # . #
        . # # # .
        # # # # #
        . # # # .
        # . # . #
        `)
    basic.pause(100)
    basic.showNumber(light)
})
input.onButtonPressed(Button.B, () => {
    Moisture = pins.analogReadPin(AnalogPin.P0)
    basic.showLeds(`
        . # # # .
        . . . . .
        . . . . .
        . . . . .
        . . . . .
        `)
    basic.pause(100)
    basic.showLeds(`
        # # # # #
        # # # # #
        . # # # .
        . . . . .
        . . . . .
        `)
    basic.pause(100)
    basic.showLeds(`
        . . # . .
        . # # # .
        # # # # #
        # # # # #
        . # # # .
        `)
    basic.pause(100)
    basic.showNumber(Moisture)
})
basic.showString("Hello!")
```

Additional Remarks:

Could add different sensors to test for temperature or other variables as well. Extension to this activity could be to test for starch in leaves with iodine using the technique below:

http://www.nuffieldfoundation.org/practical-biology/testing-leaves-starch-technique