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Feast or Famine Terrarium Project (Resource Exchange)

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Overview

Program Description: Through a project funded by the Science Education Partnership Award of the National Institute of General Medical Sciences, a team of faculty, staff, and graduate students from Dartmouth as well as educators from a local science museum are collaborating with middle-school STEM teachers from rural schools to develop project-based curricula.

The Feast and Famine curriculum focuses on having middle school students build a terrarium, plant and care for edible seeds/plants, design experiments, design and build measurement tools, and assess how different factors affect the plants in their terraria. This is an interdisciplinary project that incorporates environmental and engineering concepts. **Engineering concepts** include the use of laser-cutters to create the acrylic terrariums (CAD files available but students can also use 2-liter bottles) and the design and use of Arduino-based tools to measure temperature, humidity, illuminance, and more. In addition, students will use time-lapse photography to monitor plant growth.

Grade Level: 7th grade

Time: The curriculum is designed to be run over 4 to 6 weeks but can be adjusted as needed.

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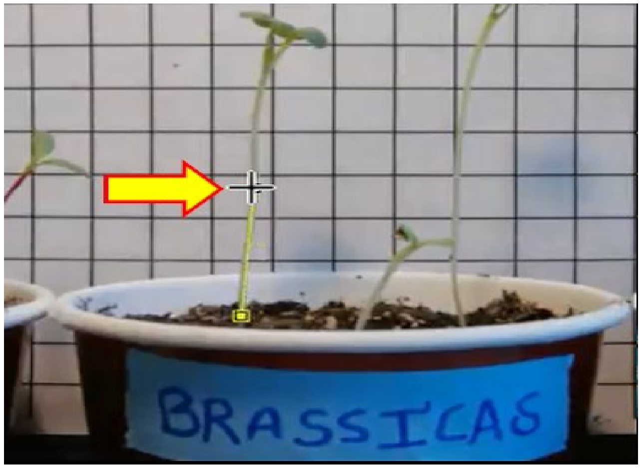


https://sepa.host.dartmouth.edu/

Learning Objectives

Next Generation Science Standards:

- MS-LS1-5. Construct a scientific explanation based on evidence for how environmental factors influence the growth of organisms.
- MS-ETS1-1. Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution.
- MS-ETS1-2. Evaluate competing design solutions using a systemic process to determine how well they meet the criteria and constraints of the problem.
- MS-ETS1-3. Analyze data from tests to determine similarities and differences among several design solutions.
- MS-ETS1-4. Develop a model to generate data for iterative testing and modifications of a proposed tool.

Supplies

- Terrariums (CAD plans or use 2L bottles)
- Soil, sand, pebbles, fertilizer
- Seeds: beet, basil, and brassica
- Grow light
- Arduino board
- USB cable
- MicroSD card reader
- Sensors: moisture, light, humidity
- Time-lapse camera
- Breadboard
- Jumper wires

Students Design and Build Arduino-Based Tools

Students use the engineering design process to design, build, modify, and test Arduino-Based Tools.

Be an Engineer

Ask — How do sensors, Arduino, and Python work? How can you use these tools?

Define — What do you need to measure? How often do you need to measure it?

Wonder — What are the possibilities? How many ideas can you come up with?

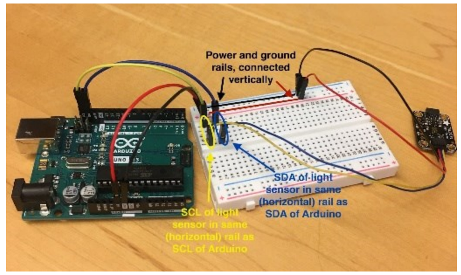
Build — What measurement tools can you build? Can you combine several tools?

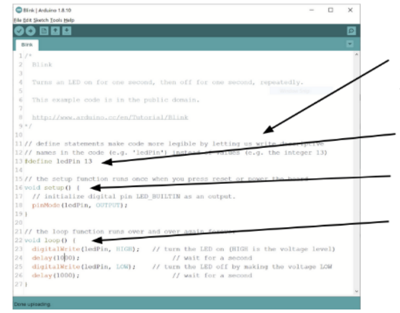
Test — Do your tools work? How can you interpret the data? How can you improve your tools?

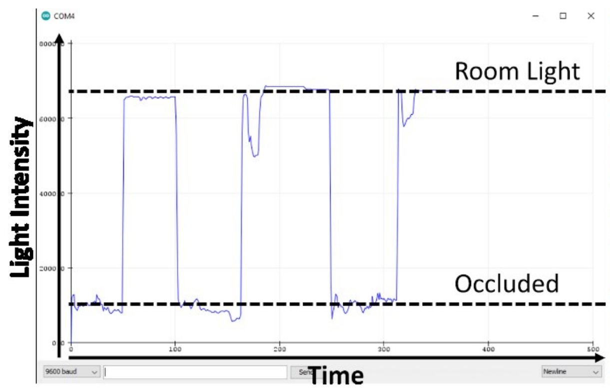
Students Design and Code Tools/Sensors to take Measurements using Arduino

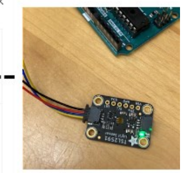
- Lesson 1: Intro to Arduino Boards and Coding
- Lesson 2: Building your first Sensor
- Lesson 3: Recording Data over Time
- Lesson 4: Integrating Multiple Sensors with a Real-Time Clock
- Lesson 5: Collecting and Interpreting Time-Lapse Imagery

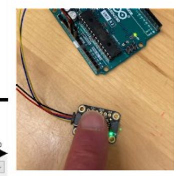
Link to lessons:
https://drive.google.com/drive/folders/1-B0s_spdqf7gszoyq_qXdqrmfp004vbL?usp=sharing

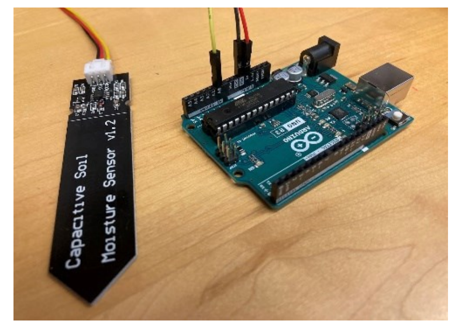












Time-Lapse Videos