Lead Information Packet
Module 2: Plants
2nd Grade

This document is not intended to give you all of the information you need to lead the module. It is only intended to be a reference during the module. You can find the complete instructions at http://www.chem.ucsb.edu/scitrek/module as well as the student notebook and picture packet used during the module.

Note: We highly recommend that teachers complete the initial and final Observation Assessments and the Technique Activity on Day 2 outside of SciTrek sessions.

Important Things to Remember During the Module

1. You are responsible for keeping track of time in the classroom and making sure that ALL activities run smoothly. There will be a time card in the lead box with suggested times to start/stop each activity.
2. You are responsible for keeping volunteers and students on track.
3. Walk around during times volunteers are working with students and help struggling groups.

Types of Documents:

Student Notebook:
One given to every student and is filled out by the student. In these instructions, the examples are rectangular and filled out in black. The lead will use a student notebook to write in as an example for students. The notebook that the lead uses is referred to as the class notebook in these instructions.

Notepad:
One given to every group and is filled out by the volunteer. In these instructions, the examples are squarer and filled out in blue.

Picture Packet:
One per class that, if needed, the lead fills out. In these instructions, the examples are rectangular, labeled, and, if applicable, filled out in blue.

In these instructions, all other example documents are labeled.
Day 1: Observation Activity/Observations/Question/Materials Page

**Note:** We highly recommend that teachers complete the initial Observation Assessment prior to Day 1 of the module. The suggested times in the lesson plan below are assuming that the Observation Assessment was given prior to SciTrek arriving.

**Schedule:** You are responsible for **BOLD sections**

<table>
<thead>
<tr>
<th>Times if teacher gave assessment prior to SciTrek</th>
<th>Times if SciTrek must give assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction (SciTrek Lead) – 2 minutes</td>
<td>Introduction (SciTrek Lead) – 2 minutes</td>
</tr>
<tr>
<td>Observation Activity (SciTrek Lead) – 12 minutes</td>
<td>Observation Assessment (SciTrek Lead) – 5 minutes</td>
</tr>
<tr>
<td>Observation Discussion (SciTrek Lead) – 7 minutes</td>
<td>Observation Activity (SciTrek Lead) – 12 minutes</td>
</tr>
<tr>
<td>Observations (SciTrek Volunteers) – 17 minutes</td>
<td>Observation Discussion (SciTrek Lead) – 7 minutes</td>
</tr>
<tr>
<td><strong>Question Discussion (SciTrek Lead) – 3 minutes</strong></td>
<td>Observations (SciTrek Volunteers) – 16 minutes</td>
</tr>
<tr>
<td>Question (SciTrek Volunteers) – 11 minutes</td>
<td><strong>Question Discussion (SciTrek Lead) – 3 minutes</strong></td>
</tr>
<tr>
<td>Materials Page (SciTrek Volunteers) – 6 minutes</td>
<td>Question (SciTrek Volunteers) – 9 minutes</td>
</tr>
<tr>
<td><strong>Wrap-Up (SciTrek Lead) – 2 minutes</strong></td>
<td>Materials Page (SciTrek Volunteers) – 4 minutes</td>
</tr>
<tr>
<td></td>
<td><strong>Wrap-Up (SciTrek Lead) – 2 minutes</strong></td>
</tr>
</tbody>
</table>

**Preparation:**

1. Get the Observation Assessments and put them in the lead box.
2. Make sure volunteers are writing their names and group color on the whiteboard.
3. Make sure volunteers are passing out nametags.
4. Make sure volunteers are setting up for the initial observation.
5. Set up the document camera to use for the Observation Activity (page 1, picture packet and page 2, student notebook).
6. Copy the chart from page 1 of the picture packet onto the board.
7. Assemble the experimental set-up demonstration.
   a. Fill two 100 mL graduated cylinders with 100 mL of water each.
   b. Fill two 3 oz. cups completely full of vermiculite.
   c. Plug in the lamp.
   d. Set out the materials above and large cup, medium cup with hole, and cloth strip where students can see.
8. Have two polarized filters and a 250 mL graduated cylinder available to show students during the observation discussion.
Notebook Pages, Notepad Pages, and Picture Packet Page:

Page 1, Picture Packet
It is recommended that instead of using this picture packet page that the lead write this chart on the board so students can refer to it while completing the Observation Activity page 2 of their notebook.
**Introduction:** (2 minutes – Full Class – SciTrek Lead)

- Allow volunteers to introduce themselves.
- Introduce the module.

**Observation Assessment:** (5 minutes – Full Class – Given By Classroom Teacher Prior to SciTrek)

- Pass out assessments and cotton balls.
- Read each statement and have students circle if the statement is an observation/not an observation.
• Collect assessments and cotton balls.

**Observation Activity: (12 minutes – Full Class – SciTrek Lead)**

- Have volunteers pass out notebooks.
- Have students fill out the front cover of their notebooks.
- Tell students we will be working to answer the question, “What variables affect plant growth?”
- Use the chart on the board that is a copy of page 1 of the picture packet (recommended) or put page 1 of the picture packet under the document camera.
- Have students help you fill in the table with what they use to make observations, along with things that are not observations.
- Have students generate an observation about something in the classroom using each of their senses except for taste.
- Have students generate one statement in each of the not observations categories.
- Have volunteers pass out mechanical pencils.
- Fill in the definition for observation with the students at the top of page 2 of their notebooks.
- Read the directions (page 2, student notebook).
- Read each statement, then give student ~15 seconds to circle if the statement is an observation or not an observation about the object (mechanical pencil). Then go over the statement as a class and have students box the correct answer.
- Review each statement and box the correct answer.
  - For statements that are observations, have students identify which sense they used. Write the sense in the margins of the class notebook (students do not have to write this in their notebook).
  - For statements that are not observations, have students identify why from the three categories on the list. Write why the statement is not an observation in the margins of the class notebook (students do not have to write this in their notebook).
    - **Number 1:** The object is smaller than a jump rope.
      - Observation – With Sense (Comparison)
      - Sense: Sight
    - **Number 2:** The object is made out of metal.
      - Not an Observation – Incorrect with Sight
        - Incorrect observation
    - **Number 3:** The object is hotter than boiling water.
      - Not an Observation – Incorrect with Sense (Comparison)
        - Incorrect observation
    - **Number 4:** The object is simple.
      - Not an Observation – Opinion
        - Opinion
    - **Number 5:** The object has a pointed end.
      - Observation – With Sight
        - Sense: Sight
    - **Number 6:** The object can be twisted at one end.
      - Observation – With Sense (Need to Test)
        - Note: If you have twisted the end of the mechanical pencil, then the statement is an observation. If you have not tested it, then the statement is not an observation, it is an inference. Make sure all students twist the end of the object to make this statement an observation.
        - Sense: Touch and Sight
    - **Number 7:** The object has been used to write many words.
      - Not an Observation – Inference
        - Inference
- Have volunteers collect mechanical pencils.
**Observation Discussion:** *(7 minutes – Full Class – SciTrek Lead)*

- Review class question, “What variables affect plant growth?”
- Tell students that we will first explore how soil type affects plant growth.
- Show students how plants were made:
  - Feed the 5 cm x 15 cm towel through the hole in the medium cup so 4 cm are sticking inside cup.
  - Place the medium cup into the large cup.
  - Put two small cups of vermiculite (make sure you use the word vermiculite with students) into the medium cup.
  - Put 1 “seed” into the vermiculite. (You will not have a seed, but pretend to put one in so students think you have a seed.)
  - Pour 200 mL of water over the vermiculite.
  - Set the cup under light.
- Have students move to their groups.
  - If a student does not have a nametag, identify the group with the least number of students in it and write the student’s name on one of the extra nametags that are in the lead box using that color of marker.

**Observations:** *(17 minutes – Groups – SciTrek Volunteers)*

- Walk around and help groups that are struggling.
- Make sure groups are moving along and only spending ~5 minutes recording observations of how the plants were made, ~5 minutes making observations of the lettered cups (just made plants), comparing relative amounts of water in each lettered cup, and discussing what this means about how much liquid the different soil types absorb, and ~5 minutes recording observations about the numbered cups (7 day old plants).

**Question Discussion:** *(3 minutes – Full Class – SciTrek Lead)*

- Have groups share what they did/learned.
  - The cups contained potting soil, vermiculite, and rocks.
  - The vermiculite absorbed the most water and the rocks absorbed the least water.
  - The plant grew the tallest in the potting soil and there was no plant growth in the rocks.
- Discuss how soil type relates to plant growth.
- Review how this finding would help someone that wants to plant a garden.
- Introduce the word “variable.”
- Go over the options for variables that students can change: light amount (show polarizing filters), liquid amount (show 250 mL graduated cylinders), nutrient amount (sugar, salt, or fertilizer).

**Question:** *(11 minutes – Groups – SciTrek Volunteers)*

- Walk around and help groups that are struggling.
- Encourage groups to pick different changing variables.

**Materials Page:** *(6 minutes – Groups – SciTrek Volunteers)*

- Give groups that are changing the water amount a 250 mL graduated cylinder and groups that are changing the nutrient amount a 100 mL graduated cylinder.
  - Volunteers can write on these with wet erase pens.
- Walk around and help groups that are struggling.
- Make sure groups fill out the materials page correctly and completely.
Wrap-Up: (2 minutes – Full Class – SciTrek Lead)

- Tell students what they will do next session.
- Make sure you leave the classroom teacher the class notebook and students’ notebooks.

Day 2: Experimental Set-Up/Procedure/Results Table/Experiment

Note: We highly recommend that teachers complete the Technique Activity prior to Day 2 of the module. The suggested times in the lesson plan below are assuming that the technique activity was given prior to SciTrek arriving.

Schedule: You are responsible for BOLD sections

<table>
<thead>
<tr>
<th>Times if teacher did technique prior to SciTrek:</th>
<th>Times if SciTrek must do technique:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction (SciTrek Lead) – 2 minutes</td>
<td>Introduction (SciTrek Lead) – 2 minutes</td>
</tr>
<tr>
<td>Experimental Set-Up (SciTrek Volunteers) – 10 minutes</td>
<td>Technique (SciTrek Lead) – 10 minutes</td>
</tr>
<tr>
<td>Procedure (SciTrek Volunteers) – 20 minutes</td>
<td>Experimental Set-Up (SciTrek Volunteers) – 7 minutes</td>
</tr>
<tr>
<td>Results Table (SciTrek Volunteers) – 5 minutes</td>
<td>Procedure (SciTrek Volunteers) – 19 minutes</td>
</tr>
<tr>
<td>Experiment (SciTrek Volunteers) – 21 minutes</td>
<td>Results Table (SciTrek Volunteers) – 5 minutes</td>
</tr>
<tr>
<td>Wrap-Up (SciTrek Lead) – 2 minutes</td>
<td>Experiment (SciTrek Volunteers) – 15 minutes</td>
</tr>
</tbody>
</table>

Preparation:

1. Have volunteers separate the notebooks into their groups, attach nametags, and set out.
2. Get SciTrek’s second grade rulers and put them in the lead box.
3. Set up the light level boxes.
   a. Set up levels 0-4 boxes in ascending order with the lids left off.
   b. Set-up a lamp for level 5 lighting. Note: This will not be in a box.
   c. Do not plug extension cords into other extension cords.
   d. Remind the teacher that it is important that the lights are left on until the next SciTrek visit.
Notebook Pages and Notepad Pages:

This is an example notebook for a group that chose light amount as their changing variable.
This is an example notebook for a group that chose nutrient amount as their changing variable.

**PROCEDURE**

**Step 1**
Plant seed in soil.

**Step 2**
Measure soil.

**Step 3**
Add liquid to soil.

**Step 4**
Light conditions.

**Step 5**
Measure plant height.

**Step 6**
Use number line to find change in plant height.

**RESULTS**

<table>
<thead>
<tr>
<th>Variables</th>
<th>Trial A</th>
<th>Trial B</th>
<th>Trial C</th>
<th>Trial D</th>
<th>Trial E</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seed Type:</td>
<td>Plant</td>
<td>Plant</td>
<td>Plant</td>
<td>Plant</td>
<td>Plant</td>
</tr>
<tr>
<td>Soil Type:</td>
<td>Potting Soil</td>
<td>100 mL</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Liquid Amount:</td>
<td>level 4</td>
<td>level 1</td>
<td>level 0</td>
<td>level 3</td>
<td>level 5</td>
</tr>
<tr>
<td>Light Amount:</td>
<td>no nutrients</td>
<td>no nutrients</td>
<td>no nutrients</td>
<td>no nutrients</td>
<td>no nutrients</td>
</tr>
<tr>
<td>Nutrient Amount:</td>
<td>3 days</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Data</th>
<th>Trial A</th>
<th>Trial B</th>
<th>Trial C</th>
<th>Trial D</th>
<th>Trial E</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial Measurements:</td>
<td>Plant Height</td>
<td>Plant Height</td>
<td>Plant Height</td>
<td>Plant Height</td>
<td>Plant Height</td>
</tr>
<tr>
<td>Final Measurements/ Observations:</td>
<td>Change In Plant Height</td>
<td>Other</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The independent variable is the changing variable and the dependent variables are the final measurement/observations.
**Introduction: (2 minutes – Full Class – SciTrek Lead)**

- Review the class question, what they learned/did last session, and what they will do today.
  - Ask students, “How will we know if a value of a variable, such as soil type, is “better” than another value?”
    - Make sure students come up with the idea of comparing plant heights.

**Technique: (10 minutes – Full Class – Done By Classroom Teacher Prior to SciTrek)**

- Show students how to use a ruler and to measure in mm.
- Read the directions on page 4 of the student notebook and answer the first question as a class.
- Have students complete the other two questions individually.
- Review each question.

**Experimental Set-Up: (10 minutes – Groups – SciTrek Volunteers)**

- Walk around and help groups that are struggling.
- Make sure all control blanks are filled out.

**Procedure: (20 minutes – Groups – SciTrek Volunteers)**

- Walk around and help groups that are struggling.
- Make sure procedure pictures have (in writing) all values of the controls, changing variable, and what data will be collected.
- Volunteers should be drawing one picture and having students copy that step before moving on to the next step.

**Results Table: (5 minutes – Groups – SciTrek Volunteers)**

- Walk around and help groups that are struggling.
- Make sure control values are written in the trial A box with an arrow through the rest of the trials’ boxes and that changing variable values are written in each trial’s box.

**Experiment: (21 minutes – Groups – SciTrek Volunteers)**

- Walk around and help groups that are struggling.
- Volunteers should write on the graduated cylinder with the wet erase pens.
- Make sure groups are recording their initial plant heights in the group notepad and in notebooks.
- Check that groups that are changing the nutrient amount are first putting the nutrient into the graduated cylinder and then adding water up to the liquid amount.
  - For example, a group that had 25 mL of sugar for its nutrient amount and 75 mL of liquid for its liquid amount would put 25 mL of sugar into the graduated cylinder and add water to the 75 mL mark (50 mL of water).
- Make sure groups are putting their plants under the correct amount of light.

**Wrap-Up: (2 minutes – Full Class – SciTrek Lead)**

- Tell students what they will do next session.
Day 3: Experiment/Graph/Results Summary

**Schedule:** *You are responsible for BOLD sections*

- **Introduction (SciTrek Lead) – 2 minutes**
- **Experiment (SciTrek Volunteers) – 30 minutes**
- **Graph (SciTrek Volunteers) – 10 minutes**
- **Results Summary (SciTrek Volunteers) – 16 minutes**
- **Wrap-Up (SciTrek Lead) – 2 minutes**

**Preparation:**

1. Make sure volunteers are setting out notebooks.
2. Remove the plants from the boxes and have them ready to pass out to groups.
3. Turn off lights and put lamps in boxes and stack boxes to be returned to SciTrek. (This can be done after the module.)

**Notebook Pages and Notepad Pages:**

![Results Table]

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**RESULTS Table**

Fill out the chart for each of your trials. For the variables that remain constant, write the value in trial A and then draw an arrow through each box to indicate the variable is a control.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Trial A</th>
<th>Trial B</th>
<th>Trial C</th>
<th>Trial D</th>
<th>Trial E</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seed Type:</td>
<td>Fast Plant</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Soil Type:</td>
<td>potting soil</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Liquid Amount:</td>
<td>100 mL</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Light Amount:</td>
<td>level 4</td>
<td>level 1</td>
<td>level 0</td>
<td>level 3</td>
<td>level 5</td>
</tr>
<tr>
<td>Nutrient Type:</td>
<td>no nutrients</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Nutrient Amount:</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time:</td>
<td>3 days</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Initial Measurements</th>
<th>Plant Height:</th>
<th>7 mm</th>
<th>11 mm</th>
<th>8 mm</th>
<th>10 mm</th>
<th>10 mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Change in Plant Height:</td>
<td>3 mm</td>
<td>4 mm</td>
<td>47 mm</td>
<td>37 mm</td>
<td>28 mm</td>
<td></td>
</tr>
<tr>
<td>Other:</td>
<td>Tall, slim, seedless, yellow leaves</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Final Measurements/Observations</th>
<th>Plant Height:</th>
<th>30 mm</th>
<th>41 mm</th>
<th>47 mm</th>
<th>37 mm</th>
<th>28 mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Change in Plant Height:</td>
<td>30 mm</td>
<td>39 mm</td>
<td>39 mm</td>
<td>27 mm</td>
<td>13 mm</td>
<td></td>
</tr>
<tr>
<td>Other:</td>
<td>Tall, skinny, small, yellow leaves</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The independent variable is the changing variable and the dependent variables are the final measurements/observations.
**Introduction:** (2 minutes – Full Class – SciTrek Lead)

- Review the class question, what they learned/did last session, and what they will do today.
**Experiment**: (30 minutes – Groups – SciTrek Volunteers)

- Help pass out plants to the correct groups.
- Walk around and help groups that are struggling.
- All measurements will be recorded in the group notepad and subtraction will be done on the notepad. Students only need to record the final plant height and the change in plant height in their notebooks.
- Check on groups that are changing nutrient amount and using salt or sugar. Some of these plants might shrink. Even if a plant shrunk, have volunteers help students find the difference between the plant heights and put a star next to the value.

**Graph**: (10 minutes – Groups – SciTrek Volunteers)

- Walk around and help groups that are struggling.
- Make sure volunteers circle the change in plant height for the trial the student is in charge of to prevent them from graphing the final plant height.
- Make sure students are graphing their trial on the individual graph piece with the value of the changing variable written underneath (Ex: 25 mL), not the trial letter (Ex: B).
  - If a plant shrunk, have students put a star above that data point on the individual graph piece.
- Make sure volunteers are having students arrange the individual graph pieces in increasing order by the change in plant height and then taping them onto the group notepad.
  - If students had plants that shrunk (starred on graph), have students put these starred values before they put the values for plants that grew when arranging the values. This will make their graph look like a parabola (U-shaped).
- Make sure students are labeling their axis and writing the numerical value of the change in plant height on top of each column.

**Results Summary**: (16 minutes – Groups – SciTrek Volunteers)

- Walk around and help groups that are struggling.
- Make sure groups are generating a claim (ideally the claim will allow them to make a prediction about future experiments) and use at least two specific data points to support it.
  - Groups will be using measurements as their data, so make sure they are including numerical values in their data statement.
  - Do not reference trial letters in the results summary.
- Volunteers struggle with results summaries, therefore, check each group’s results summary.
- Make sure students fill out the sentence frame on page 8, “I acted like a scientist when.”

**Wrap-Up**: (2 minutes – Full Class – SciTrek Lead)

- Tell students what they will do next session.

**Day 4: Poster Making**

**Schedule**: You are responsible for BOLD sections

- Introduction (SciTrek Lead) – 2 minutes
- Experimental Discussion (SciTrek Volunteers) – 17 minutes
- Poster Making (SciTrek Volunteers) – 36 minutes
- Wrap-Up (SciTrek Lead) – 5 minutes
Preparation:

1. Make sure volunteers are setting out notebooks.
2. Find a place to leave student posters.

Poster and Highlighted/Numbered Notebook Pages:

A larger version of this poster is in your lead box.
Introduction: (2 minutes – Full Class – SciTrek Lead)

- Review the class question, what they learned/did last session, and what they will do today.

Experimental Discussion: (17 minutes – Groups – SciTrek Volunteers)

- Make sure each group is explaining their experiment and their findings to their volunteer.
- Make sure volunteers are asking students questions that make them have to generate predictions based on their data.

Poster Making: (36 minutes – Groups – SciTrek Volunteers)

- Help volunteers glue poster pieces onto the posters. When gluing, make sure you or the volunteers (not the students) are gluing the poster in the exact order that is shown on the diagram and that the poster has a landscape orientation.
- Make sure the student in each group who is presenting the results graph has the appropriate sentence frame sticker in their notebook and the volunteer has gone over how to present the five sentences with the student several times.
- Make sure the volunteer is asking the student that is completing the procedure to tell them in their own words what they did in each step, and that the volunteer is writing the student’s words on each picture to form complete sentences. Students should not write these words on their poster piece. Example possible words are the boxed in the procedure pictures above.
- Each student should have the part(s) that they are presenting highlighted and numbered in their notebook: 1) scientists’ names, 2) question, 3) experimental set-up, 4) procedure, 5) results graph, and 6) results summary (see pictures above).
  - Remind volunteers that if a student is presenting multiple parts, they should have multiple sections highlighted and numbered in their notebook.
- Volunteers often forget to highlight student notebooks, so make sure this is done before Day 5.

Wrap-Up: (5 minutes – Full Class – SciTrek Lead)

- Ask students the following questions:
  - How did you act like a scientist during this project?
  - What did you do that scientists do?
Day 5: Poster Presentations

Schedule: You are responsible for **BOLD** sections

- **Introduction (SciTrek Lead)** – 2 minutes
- **Practice Posters (SciTrek Volunteers)** – 15 minutes
- **Poster Presentations (SciTrek Volunteers/SciTrek Lead)** – 41 minutes
- **Wrap-Up (SciTrek Lead)** – 2 minutes

Preparation:

1. Make sure volunteers are setting out notebooks.
2. Assign volunteers a new group to work with.
3. Set up the document camera to use for the Notes on Presentations (page 2, picture packet).
4. Organize posters so experiments featuring the same changing variable are presented back to back and posters are presented from easiest to understand to hardest to understand (suggested order: nutrient amount (salt, sugar, fertilizer), water amount, light amount).

Picture Packet Page:

```
<table>
<thead>
<tr>
<th>Group 1</th>
<th>Changing Variable:</th>
<th>Nutrient Amount (ml)</th>
<th>Plant Height (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Plant Amount</td>
<td>30 75 20 15 10</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Change in Plant Height</td>
<td>5 0 5 14 10</td>
<td></td>
</tr>
<tr>
<td>Summary</td>
<td></td>
<td>The less salt, the taller the plant. Too much salt can make plants shrink.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Group 2</th>
<th>Changing Variable:</th>
<th>Water Amount (ml)</th>
<th>Change in Plant Height (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>100 80 40 160 180</td>
<td>14 15 14 17 18</td>
</tr>
<tr>
<td>Summary</td>
<td></td>
<td>Water amount does not affect plant growth.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Group 3</th>
<th>Changing Variable:</th>
<th>Light Amount (hours)</th>
<th>Change in Plant Height (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>5 4 3 2 0</td>
<td>5 11 14 21 28</td>
</tr>
<tr>
<td>Summary</td>
<td></td>
<td>The less light, the taller the plant.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Group 4</th>
<th>Changing Variable:</th>
<th>Light Amount (hours)</th>
<th>Change in Plant Height (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>15 25 27 30 39</td>
<td>15 25 27 30 39</td>
</tr>
<tr>
<td>Summary</td>
<td></td>
<td>Group 4 plants in pots grew taller than plants in vermiculite.</td>
<td></td>
</tr>
</tbody>
</table>
```
**Introduction: (2 minutes – Full Class – SciTrek Lead)**

- Review the class question, what they learned/did last session, and what they will do today.
- Tell students that today they will work with a new volunteer.

**Practice Posters: (15 minutes – Groups – SciTrek Volunteers)**

- DO NOT GIVE STUDENTS MORE THAN 15 MINUTES TO PRACTICE OR YOU WILL RUN OUT OF TIME FOR PRESENTATIONS.
- Have volunteers rotate groups so that each group can explain their experiment and practice their poster with a new volunteer.
- Make sure volunteers are having students explain their experiment and asking them questions that make them generate predictions based on their data.
- Make sure students are reading from their notebook and practicing the poster in the following order: 1) scientists’ names, 2) question, 3) experimental set-up, 4) procedure, 5) results graph, and 6) results summary. They will NOT read the “I acted like a scientist when” or results table from their poster.

**Poster Presentations: (41 minutes – Full Class – SciTrek Volunteers/SciTrek Lead)**

- Have students present their posters.
- While posters are being presented, record each group’s changing variable values and their data on page 2 of the picture packet.
  - After groups read their question, stop the presentation and have the class identify the changing variable. Then record it in the picture packet.
  - When groups read their results graph, record the values of the changing variable and their measurements.
- After each presentation, ask students:
  - What questions do you have for this group?
- Once students have asked their questions (make sure each student answers a question; you should ask at least one question per presentation) ask students:
  - What was the group’s changing variable?
  - What pattern do you see in the (insert changing variable)?
  - What pattern do you see in the change in plant height?
  - Can someone put what we learned into a sentence?
- Record what they learned under the summary on page 2 of the picture packet.
- After all presentations are over, have students tell you the variable values that they would select for each scenario: 1) to allow a plant to grow as tall as possible and 2) to allow a plant to grow as healthy (greenest leaves) as possible.

**Wrap-Up: (2 minutes – Full Class – SciTrek Lead)**

- Tell the students that the volunteers that have been working with them are undergraduate and graduate students that volunteer their time so that they can do experiments. Have the students say thank you to the volunteers. This is the last day with their SciTrek volunteers, therefore, they should say goodbye to them.
- Tell students to remove the paper part of their nametag from the plastic holder and that they can keep the paper nametag but need to give the plastic holder back to their volunteer.
Day 6: Draw a Scientist/Tie to Standards/Content Assessment

Note: We **highly recommend** that teachers complete the final Observation Assessment prior to Day 6 of the module. The suggested times in the lesson plan below are assuming that the observation assessment was given prior to SciTrek arriving.

**Schedule:** *You are responsible for BOLD sections*

<table>
<thead>
<tr>
<th>Times if teacher gave assessment prior to SciTrek:</th>
<th>Times if SciTrek must give assessment:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Draw a Scientist (SciTrek Lead) – 5 minutes</td>
<td>Observation Assessment (SciTrek Lead) – 10 minutes</td>
</tr>
<tr>
<td>Tie to Standards (SciTrek Lead) – 45 minutes</td>
<td>Draw a Scientist (SciTrek Lead) – 5 minutes</td>
</tr>
<tr>
<td>Content Assessment (SciTrek Lead) – 10 minutes</td>
<td>Tie to Standards (SciTrek Lead) – 40 minutes</td>
</tr>
<tr>
<td></td>
<td>Content Assessment (SciTrek Lead) – 10 minutes</td>
</tr>
</tbody>
</table>

**Preparation:**

1. Get the Observation Assessments and put them in the lead box.
2. If the teacher is not leading the Tie to Standards Activity do the following:
   a. Ask the teacher if they completed the SciTrek final survey. If not, give them the QR code from the lead box and ask them to go to the website (at a later time) and fill out the evaluation of the program.
   b. Give the teacher an extra student notebook and have them fill it out with their students during the Tie to Standards Activity.
   c. Collect the teacher’s lab coat and put it in the lead box.
3. If you are a teacher and have not completed the SciTrek final survey, take the QR code from the lead box and use it to fill out the evaluation of the program at a later time.
4. Pass out notebooks.
5. Set up the document camera to use for the Tie to Standards Activity (pages 8-12, student notebook) and Tie to Standards pictures (pages 3-10, picture packet).
6. Have the 6 plants ready to show students.
7. Put your lab coat in the lead box at the end of the day.
I acted like a scientist when I measured the height of the plant in mm.

TIE TO STANDARDS

1. Is plant growth predictable?

You would like to grow the tallest plant, circle the values below that would allow you to do this. If the variable does not affect how tall the plant will grow then circle either.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Option 1</th>
<th>Option 2</th>
<th>Either</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soil Type</td>
<td>Gravel</td>
<td>Pebble</td>
<td>Either</td>
</tr>
<tr>
<td>Water Amount (in Bottom Cup):</td>
<td>100 mL</td>
<td>50 mL</td>
<td>Either</td>
</tr>
<tr>
<td>Nutrients (Salt) Amount:</td>
<td>None</td>
<td>50 mL</td>
<td>Either</td>
</tr>
</tbody>
</table>

Class Prediction

<table>
<thead>
<tr>
<th>Plant Height (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
</tr>
<tr>
<td>90</td>
</tr>
<tr>
<td>80</td>
</tr>
<tr>
<td>70</td>
</tr>
<tr>
<td>60</td>
</tr>
<tr>
<td>50</td>
</tr>
<tr>
<td>40</td>
</tr>
<tr>
<td>30</td>
</tr>
<tr>
<td>20</td>
</tr>
<tr>
<td>10</td>
</tr>
<tr>
<td>0</td>
</tr>
</tbody>
</table>

Light / No Water

<table>
<thead>
<tr>
<th>Day</th>
<th>Light No Water</th>
</tr>
</thead>
<tbody>
<tr>
<td>Day 0</td>
<td>0 mm</td>
</tr>
<tr>
<td>Day 5</td>
<td>0 mm</td>
</tr>
<tr>
<td>Day 10</td>
<td>0 mm</td>
</tr>
<tr>
<td>Day 15</td>
<td>0 mm</td>
</tr>
</tbody>
</table>

Light Water

<table>
<thead>
<tr>
<th>Day</th>
<th>Light Water</th>
</tr>
</thead>
<tbody>
<tr>
<td>Day 0</td>
<td>0 mm</td>
</tr>
<tr>
<td>Day 5</td>
<td>23 mm</td>
</tr>
<tr>
<td>Day 10</td>
<td>73 mm</td>
</tr>
<tr>
<td>Day 15</td>
<td>100 mm</td>
</tr>
</tbody>
</table>
2. Do plants grow in the light?
Plot the data for the plants with water and with no water in the light.

3. What did plants in the light need to grow? **Water**

### Class Prediction

<table>
<thead>
<tr>
<th>Day</th>
<th>Dark</th>
<th>No Water</th>
</tr>
</thead>
<tbody>
<tr>
<td>Day 0</td>
<td>0 mm</td>
<td></td>
</tr>
<tr>
<td>Day 5</td>
<td>0 mm</td>
<td></td>
</tr>
<tr>
<td>Day 10</td>
<td>0 mm</td>
<td></td>
</tr>
<tr>
<td>Day 15</td>
<td>0 mm</td>
<td></td>
</tr>
</tbody>
</table>

### Experimental Data

<table>
<thead>
<tr>
<th>Day</th>
<th>Dark Water</th>
</tr>
</thead>
<tbody>
<tr>
<td>Day 0</td>
<td>0 mm</td>
</tr>
<tr>
<td>Day 5</td>
<td>49 mm</td>
</tr>
<tr>
<td>Day 10</td>
<td>93 mm</td>
</tr>
<tr>
<td>Day 15</td>
<td>94 mm</td>
</tr>
</tbody>
</table>
4. Do plants grow in the dark? Plot the data for the plants with water and with no water in the dark.

<table>
<thead>
<tr>
<th>Dark / No Water</th>
<th>Dark / Water</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>90</td>
<td>90</td>
</tr>
<tr>
<td>80</td>
<td>80</td>
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<td>20</td>
<td>20</td>
</tr>
<tr>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

5. What did plants in the dark need to grow? Water

Plants in the Light

Day ___

Day ___

Day ___

Plants in the Dark

Day ___

Day ___

Day ___

Day ___

6. Label the following picture of plants in the light with water with the correct day number (0, 5, 10, or 15 days) on which they were taken.

Day 0

Day 5

Day 10

Day 15

7. Label the following picture of plants in the dark with water with the correct day number (0, 5, 10, or 15 days) on which they were taken.

Day 0

Day 5

Day 10

Day 15
Observation Assessment: (5 minutes – Full Class – Given By Classroom Teacher Prior to SciTrek)

- Pass out assessments and black beads.
- Read each statement and have students circle if the statement is an observation/not an observation.
- Collect black beads.
- Have students turn the page over and answer the Attitudes Towards Science Questions.
- Collect assessments.

Draw a Scientist: (5 minutes – Full Class – SciTrek Lead)

- Pass out the Draw a Scientist page.
- Give students exactly 4 minutes to draw a picture of a scientist.
- If the students drew a specific person, have them write who they drew on the line at the bottom of the page. Have them leave it blank if it is just a general person/picture.
- Collect assessments.

Tie to Standards: (45 minutes – Full Class – SciTrek Lead)

Plant Growth Predictability: (5 minutes)

- Ask students if plant growth is predictable.
- Have students predict which soil type would give the tallest plant and have them share their reasoning.
- Show students corresponding plants.
- Repeat process for water amount and nutrient (salt) amount.
**Plants in the Light Prediction: (10 minutes)**

- Have students predict what they think will happen to the plant height if a seed is planted in the light with no water and left there for 15 days.
- Record student ideas on the class prediction graph (page 3, picture packet).
- Have students predict what they think will happen to the plant height if a seed is planted in the light with water and left there for 15 days.
- Record student ideas on the class prediction graph (page 4, picture packet).

**Effect of Light and Water on Plant Growth: (10 minutes)**

- As a class, graph together what happened to a seed in the light with no water over the course of 15 days (page 5, picture packet [a sheet of paper is behind page 5 to cover data that you do not want students to see]).
- Compare class predictions to actual data.
- As a class, graph together what happened to a seed in the light with water over the course of 15 days (page 5, picture packet).
- Compare class predictions to actual data.
- Ask the students, “What did plants in the light need to grow?”
  - Water

**Plants in the Dark Prediction: (6 minutes)**

- Have students predict what they think will happen to the plant height if a seed is planted in the dark with no water and left there for 15 days.
- Record student ideas on the class prediction graph (page 6, picture packet).
- Have students predict what they think will happen to the plant height if a seed is planted in the dark with water and left there for 15 days.
- Record student ideas on the class prediction graph (page 7, picture packet).

**Effect of Darkness and Water on Plant Growth: (7 minutes)**

- Have students graph what happened to a seed in the dark with no water over the course of 15 days (page 8, picture packet).
  - As students are graphing the data, graph the data on the class notebook so that students can compare their graphs to your graph.
- Compare class predictions to actual data.
- Have students graph what happened to a seed in the dark with water over the course of 15 days (page 8, picture packet).
- Reveal the points one by one but give students ~30 seconds to try to graph the point on their own before moving to the next point.
- Compare class predictions to actual data.
- Ask the students, “What did plants in the dark need to grow?”
  - Water
- Ask the students “Why do you think the plant in the dark with water grew taller and faster than the plant in the light with water?”
Matching Plant Growth Pictures: (4 minutes)

- Have students look at the colored pictures of plant growth in the light (page 9, picture packet) and have students identify which picture matches with each day.
- Have students look at the colored pictures of plant growth in the dark (page 10, picture packet) and have students identify which picture matches with each day.
- Ask students how the appearance of plants differed when they were in the light and in the dark.

Ideal Conditions for Plant Growth: (3 minutes)

- Discuss question 8: Is water or light more important for plant growth?
  - Water
- Discuss question 9: Which would you predict to be taller at day 10, a plant in the light with water or a plant in the dark with water?
  - Dark
- Discuss question 10: Which would you predict to be healthier (greener and more leaves) at day 10, a plant in the light with water or a plant in the dark with water?
  - Light
- Ask students, “What conditions are needed in order for plants to live the longest life?”
  - Water
  - Light

Variables: (Time Permitting)

- ONLY DO THIS SECTION IF THERE IS TIME.
- Review the definition of a variable with the class.
  - Something that you can change in an experiment.
- Have students brainstorm other variables (that were not tested) that might affect plant growth.
  - Temperature
  - Size of container
  - Type of plant

Content Assessment: (10 minutes – Full Class – SciTrek Lead)

- Pass out Content Assessments and rulers.
- Read each question to students.
- Collect rulers as soon as students answer question 1.
- Collect Content Assessments.
**Extra Practice Solutions:**

### EXTRA PRACTICE

<table>
<thead>
<tr>
<th>Observation: A description using your senses.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Circle OBSERVATION if the statement is an observation you can make about the picture. Circle NOT AN OBSERVATION if the statement is not an observation you can make about the picture.</td>
</tr>
</tbody>
</table>

1. The boy is smiling.  
2. The boy is wearing a black shirt.  
3. The measuring cup is larger than the oil bottle.  
4. Cooking is exciting.  
5. There are equal number of measuring cups and bottles.  
6. The boy's hair is black.  
7. The boy is making something to eat.

<table>
<thead>
<tr>
<th></th>
<th>Observation</th>
<th>Not an Observation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
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<tr>
<td>4</td>
<td></td>
<td></td>
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<td>5</td>
<td></td>
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<tr>
<td>6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>