

Focus: Developing a Hypothesis
Grade Level: Fifth Grade
Module Length: 2-2.5 hours

Driving Questions

- How do we want to change our model?
- What are our hypotheses for the Project Crystal research questions?

NGSS Links

- 5-LS1-1
- 5-LS2-1
- Planning Investigations
- Engaging in Argument from Evidence

Systems Thinking Characteristics

- Making Predictions Based on Understanding of System Mechanics
- Thinking Temporally & Predicting Change Over Time

In the fourth module of Project Crystal, students prepare to collect data for the Project Crystal mulch experiment by developing hypotheses for the two Project Crystal research questions.

First, students identify what they need to compare and what evidence they need to answer our research questions this year. Next, if they've taken part in the optional Module 3, students update their models of the ecosystem based on any new information that they have learned. Finally, they use their models to develop two hypotheses for the two research questions.

Learning Outcomes & Assessments

| <i>By the end of this module, students will be able to...</i> | <i>You can assess this using...</i> |
|---|---|
| 1. Describe what we need to compare and what evidence we need to answer our research questions. | Science journals; Observations of class discussion |
| 2. Identify new information they learned in Module 3, and use it to make changes to their models (optional). | Science journals |
| 3. Use their understanding of the Moro Canyon ecosystem to develop two hypotheses about how water-saver and water-spender plants will affect insect abundance and bird activity. | Science journals, Observations of class discussion |

Module Overview

| Section | Session Title | Length | Format |
|----------------|---|---------------|-----------------------------|
| Launch | <p><i>Planning Our Experiment</i></p> <p>Students review the two Project Crystal research questions and identify what we can compare and what evidence we need to gather to answer those questions.</p> | 15-20 minutes | Whole class or individual |
| Explore | <p><i>Revising Our Models (optional)</i></p> <p>Students revisit what they learned in Module 3 and use any new information to make changes to their models to better reflect the real-world system in Moro Canyon.</p> | 30 minutes | Whole class or individual |
| | <p><i>Developing Our Hypothesis</i></p> <p>Using their model as evidence, students predict how planting water-spenders and water-savers will affect insect and bird activity over time and develop hypothesis for the two research questions.</p> | 30-45 minutes | Whole class or individual |
| Share | <p><i>Sharing Our Hypothesis</i></p> <p>In a group discussion, students share their hypotheses and reasoning with each other.</p> | 15-20 minutes | Whole class or small groups |
| Extend | <p><i>Explore at Home: Community Interview (Optional)</i></p> <p>Students find a plant or animal expert in their community such as a friend or family member who gardens, bird watches, hikes, cooks, or otherwise has knowledge of plants and animals.</p> | 30 minutes | Individual |
| Reflect | <p>They plan and conduct an interview with their expert to learn more about their knowledge.</p> | | |
| | <p><i>What was your hypothesis?</i></p> <p>Students share what they would expect to see at the research site if their hypothesis is supported.</p> | 15 minutes | Individual |

Materials

- **Module 4 Launch Slideshow**
- **Revising Our Model Slideshow** (optional)
- **Making Our Hypothesis Slideshow**
- **Module 4 Share Slideshow**
- **Module 4 Explore at Home Slideshow** (English)
- **Module 4 Explore at Home Slideshow** (Spanish) (coming soon)
- **Module 4 Explore at Home Family Directions** (English) (coming soon)
- **Module 4 Explore at Home Family Directions** (Spanish) (coming soon)
- **Module 4 Reflection Video Prompt:**
 - **Option 1: Flipgrid**
 - **Option 2: Padlet**
 - **Option 3: Video** to host on the private platform of your choice

Each student will need...

- Science journal and pencil
- Access to their models from Module 2

Before You Start Teaching

- Copy over the over the **Launch Slideshow**, the **Revising our Model Slideshow**, the **Making our Hypothesis Slideshow**, the **Share Slideshow**, and **Explore at Home Slideshow** to your own Google Drive account.
- Decide if you would like students to revise their original models. This section builds off of the optional Module 3. If you have completed any of the Module 3 investigations, or if considerable time has passed since students created their models in Module 2, consider including this section.
- Decide how you will host the Share discussion for this module. If your class already has established science communication norms, open your copy of the **Share Slideshow** and update **Slide 3** with your discussion guidelines and **Slide 4** with any sentence starters.
- Decide how you want students to share their reflections. They can post their thoughts publicly on Crystal Cove Conservancy's Flipgrid or Padlet, or you can host the discussion prompt video on the platform of your choice. We recommend sticking to the same format as the previous module.

Learning Sequence

Launch

Planning Our Experiment (20-30 minutes)

Slideshow Link

In this slideshow, Kaitlin reminds students of the two research questions that we will be investigating this year for Project Crystal:

- **Research Question 1: Insect Abundance:** Which plant mix has the highest number of insects present and which has the lowest number of insects present: water-saver plants, water-spender plants, or non-native plants?
- **Research Question 2: Bird Activity:** Where will we find the highest number of bird attacks on clay caterpillars and where will we find the lowest number of bird attacks on clay caterpillars: water-saver plants, water-spender plants, or non-native plants?

Students then start thinking about how to set up an experiment to answer the two research questions. They identify what variables they need to compare and reflect on the evidence they would need to answer the two questions.

This slideshow can be assigned independently or shared with the whole group. Students can look at the Google Slides presentation and watch videos on their own, or you can choose to present it to the whole class.

Explore

Revising Our Models (30 minutes)

Slideshow Link

In this optional activity, students look back at their Session 2 models and the notes they created in Module 3: Digging Deeper and make a list of at least three changes that they want to make to their model based on new information they have learned. They then return to their models and make those changes. If students created their models on paper, you can have them make changes by adding in sticky notes, or have them re-draw their model with new changes.

You can assign this slideshow independently for students to work on on their own, or share with the whole group, and have students update their models together as a class.

Making Our Hypothesis (30-45 minutes)

Slideshow Link

In this investigation, Kaitlin introduces the students to the format they will use to write their hypotheses by demonstrating with an example from a previous Project Crystal Experiment. Students then work independently to use a sentence frame to write their own hypotheses about soil moisture and plant growth.

You can assign this slideshow independently for students to work through on their own, or share with the whole group and have the students work on their hypotheses in small groups.



Share

Discussion: Sharing Our Hypotheses (20-30 minutes)

Slideshow Link

Once students have developed their hypotheses, this discussion lets them share their thoughts with each other. Before diving into the Module 4 discussion questions, you can remind students again of the science communication norms. Suggested norms and sentence starters are included in the Google Slides presentation, although you can edit them or use your own!

During the discussion, make sure to highlight any places where students have differing ideas. Emphasize that some students might have the same hypotheses, and some might differ, and that's okay! This is an opportunity for students to share their reasoning and explain their thinking with each other. Since we don't know the answer to our research questions yet, there are no wrong answers as long as we can support our ideas.

Extend

Explore at Home: Gardening Scavenger Hunt (30 minutes)

Slideshow Link (English)

Slideshow Link (Spanish) (coming soon)

Family Directions (English) (coming soon)

Family Directions (Spanish) (coming soon)

During this optional Explore at Home Investigation, students find a family member or friend who knows a lot about plants or animals. These experts could be gardeners, bird watchers, people who love to cook, people who know about medical plant uses, nature lovers, or people who carve wood. Students come up with questions to ask their chosen plant or animal expert and conduct an interview to learn more about plant knowledge beyond just the ecological study of plants and animals that we focus on in Project Crystal.

As an extension, you might choose to have students share what they found with their classmates, either during a small group discussion or by filming a video for Flipgrid or another platform.

Reflect

Reflection Question: What is your hypothesis? What would you expect to find at our research site if your hypothesis is supported? (15 minutes)

Flipgrid Link

Padlet Link

Video Link

At the end of the module, students share their hypotheses and what they predict might happen when they virtually collect data at the research site. Students can share their reflections with the broader Project Crystal community on our public Padlet or Flipgrid pages, or you can host the video reflection prompt on your own discussion platform of choice.