Crystal Cove® CONSERVANCY

Session 3: Building a Model

Focus: Creating a System Model
Grade Level: 3-5
Session Length: 45-75 minutes

Driving Questions

- What research question do we want to investigate?
- What components and processes affect the growth and survival of plants in our gardens?
- How can we create a model that shows whether or not a specific plant might grow and survive without getting eaten by insects?

NGSS Links

- Designing and Using Models

Systems Thinking Characteristics

- Identifying System Components & Processes
- Identifying Simple Relationships Between System Components
- Organizing System Components & Processes within a Framework of Relationships
- Identifying Hidden Dimensions of the System

In the third session of Project Crystal, students work with their research teams to select a research question and design a model that shows their initial ideas about the investigation.

During the first part of the session, research teams decide on two plants with differing traits to focus on for their experiment. They then come up with their own research question. After, the research teams brainstorm a list of biotic components, abiotic components, and processes that affect the growth and survival of a plant in their garden. Finally, the teams work together to collaboratively design a model that show their initial ideas about how plant traits affect whether a plant can survive without getting eaten by insects.

Learning Outcomes & Assessments

By the end of this module, students will be able to...	*You can assess this using...*
1. *Develop* a research question to investigate a plant trait that might affect how many caterpillars are eaten by birds.	Science journals
2. *Generate* a list of components and processes that affect the growth and survival of plants in their garden.	Science journals
3. *Design* a model that compares how their chosen plant traits Research team models affect whether or not a plant can grow and survive without getting eaten by caterpillars.	Research team models

Session Overview

Section	Description	Length	Format
Launch	Students watch a video that introduces them to the task for the day: to create a model of the ecosystem in their garden.	5 minutes	Whole group
Explore	Students choose two plants to compare in their experiment and develop a research question.	10-20 minutes	Research teams
	Students generate a list of components and processes that affect the survival and growth of a plant in their garden.	10 minutes	Individual
	Research teams then work together to create a collaborative model of the ecosystem that shows how they think the different parts of the system interact to affect whether or not a plant can survive without getting eaten by insects.	20-30 minutes	Research teams
Share	If there is time, students share their models with the whole class.	5 minutes	Whole class
Reflect	Students reflect on what they've learned from their model.	5 minutes	Individual

Materials

- ***Session 3 Google Slides Presentation***
- Science Journals and pencils (1 per student)
- Poster board or large paper for modeling (1 per research team)
- Colored pencils or markers

Before You Start Teaching

- Copy over the Session 3 Slideshow to your own Google Drive account. Test to make sure that the videos work. (If not, you may have to check the permissions on the Crystal Cove Conservancy Youtube Account.)

- During Session 3, students will need to choose one plant trait that might affect whether or not the caterpillars get eaten, and then select two plant species that represent that trait to use in their investigation. Before starting this session, it will be helpful for you to come up with a few example questions so that you're prepared to support students if they get stuck.

  Review any notes that you took during Session 2, when students investigated the garden. Consider which plant trait might be interesting for students to compare.

  Some example plant traits that you might compare include:
  - Plants with big leaves versus plants with small leaves
  - Plants with woody branches versus plants with soft green stems
  - Plants with yellow flowers versus plants without flowers

  For the experiment, you'll also need to choose two plant species which are emblematic of the traits that you want to compare. Ideally, there should be 3-5 examples of each plant in the garden or around the school. Look back at your notes and think about which of the plant species you identified in Session 2 could represent each trait.

- Once you've reviewed possible research questions, consider how you want to have students select their research question. You can have them pick one question as a whole class or group, which will be easiest to manage. You can also let each research team choose their own plants to compare, which will give them more choice but will be more complicated for you to direct. Either way, be prepared to give them examples of possible traits to compare and possible plant species to represent each trait.

Learning Sequence

Launch

Getting Started with Modeling (5 minutes)

1. Open the ***Session 3 Slideshow*** and play the video on ***Slide 2*** for your group. In this video, Kaitlin will briefly introduce Session 3 and the fact that students will work in their research teams to build a model of the ecosystem in their garden to help us make predictions for our experiment.

2. Next, move on to ***Slide 3***, which gives an overview of what students will do and learn during Session 3.

Part 1: Developing our Research Questions (10 minutes)

1. Play the video on ***Slide 4***, where Kaitlin will introduce the first step in planning our experiment: choosing plant traits to compare.

2. After you're done watching the video, advance to ***Slide 5***, which describes the task for the students: they need to decide which plant trait they want to compare, and then choose two plant species with those different traits to compare for their experiment. You can decide whether to choose which traits to compare as a whole class (which will take less time) or let each research team come up with their own research question.

Encourage students to look at their field notebooks and read through their notes from Session 2. If you have time, you can also return to the garden to look at the plants again.

As students are deciding on plants and their traits to investigate, some things to keep in mind and ask the students as they are choosing:

- How are the two plants different?
- What trait is different between them that would affect how well birds are able to eat the caterpillars?
- Do we have more than one of each plant? (It might be hard to set up a study with just one individual of each type.)

Explore

Building a Model Part 2: Brainstorming Components & Processes (5-10 minutes)

1. Advance to ***Slide 6*** and play the video. Kaitlin will introduce students to the first task in creating their model: they will need to brainstorm a list of abiotic components, biotic components, and processes that affect the survival and growth of a plant in their garden.

2. Once the video is done, move on to ***Slide 7*** and reiterate the task for students: They will brainstorm a list of abiotic components, biotic components, and processes that affect the survival and growth of a plant in their garden, and record their list in their Science Journals.

Some tips to share with students:

- We want to think about anything in the ecosystem that they think might affect how well our plants are able to survive.
- Try to sort the list into abiotic components (non-living things), biotic components (living things), and processes (things that happen).
- For now, all ideas are good ones! Your research team will be able to decide which components and processes are most important later to add to the final model later.
- It's okay to think categorically rather than worry too much about particulars (saying "herbivores" or "birds" instead of naming exact species found in your gardens).

3. Give students five minutes to brainstorm their list. If possible, give them a two-minute reminder before the end of the brainstorming time.

4. When the research teams are done brainstorming, play the video on Slide 8. In this video, Kaitlin will challenge students to pick the 10-12 items from their list that have the biggest effect on the plants in their gardens.

5. Move on to ***Slide 9*** and give them two minutes to choose the 10-12 items on their shared list that they think will be most important to include in their team model.

If there is time, ask the students to share some of the final components and processes on their list with their research teams.

Part 3: Building a Model (20-25 minutes)

1. Once students have finished narrowing down their list of components and processes, move on to ***Slide 10*** and play the video for the whole class. This will demonstrate how they can draw a model of the ecosystem.

2. Move on to ***Slide 11***, which frames the task for students. They will need to draw a model comparing the two species in their experiment to help them think about how the differences between the two species might affect how well the plants grow and survive without being eaten by caterpillars.

3. Hand out out to each team a large piece of paper or poster board and markers or colored pencils to draw their models. Have the students work together in their research teams to build a model of the system that incorporates all of their components and processes.

4. Give the teams twenty minutes to work with their team members and circulate to check on their progress as they work. Remind them to add connections to all of the components of the system that they think might interact, and label the parts of their model to explain their thinking. Encourage them to think specifically about how the interactions might be different depending on their chosen plant traits to compare.

Share

Sharing Our Models (5-10 minutes)

1. If there is time, gather the entire group and invite the research teams to share their models.

Reflect

Reflecting on Session 3 (5 minutes)

1. Tell students they have one last task, and move on to the final slide**,** which will share reflection questions. Ask students to spend five minutes reflecting on their experiences today in their science journals.

2. Finally, if you are able, thank the class for their time today. Tell them that when you gather again, they will set up the experiment in the garden and use their models to come up with a hypothesis, or prediction for their research questions.