Crystal Cove® CONSERVANCY | Module 6: Analyzing Data

Focus: Analyzing & Interpreting Data
Grade Level: Fifth Grade
Module Length: 2.5-4 hours

Driving Questions
- How can we use mathematical ideas and graphs to represent our data?
- Do patterns in our data support or not support our hypothesis?
- What is our recommendation to share with Crystal Cove State Park?

NGSS Links
- Analyzing & Interpreting Data
- Using Mathematics & Computational Thinking
- Constructing Explanations
- Communicating Information

Systems Thinking Characteristics
- Identifying Patterns Not Seen on the Surface
- Proposing Explanations Based on Data

In the sixth and final module of Project Crystal, students analyze their data and construct a recommendation for Crystal Cove State Park.

Initially, students apply ideas about statistics to find the mean of each group of data. Next, they learn how to use SageModeler to create graphs, which they use to look for patterns in their data. They reflect on the graphs in their science notebooks, check to see whether their hypotheses were supported or not supported, and then write a recommendation about which type of plants they think Crystal Cove State Park staff should use in future restoration.

Finally, they share their recommendation back with Crystal Cove Conservancy and (in an optional extension) with their family, classmates, or community.

Learning Outcomes & Assessments

| By the end of this module, students will be able to...	You can assess this using...
1. *Describe* how scientists use averages and graphs to represent a data set.	Science journals; Observations of class discussion
2. *Calculate* the average for a group of numbers.	Science journals
3. *Create* a graph in SageModeler to make inferences based on it.	Science journals; Observations of class discussion
4. *Use* evidence and reasoning to support a claim.	Science journals; Observations of class discussion
5. *Communicate* their ideas and share their recommendation with Crystal Cove State Park.	Science journals; Observations of class discussion; Individual reflections

Module Overview

Section	Session Title	Length	Format
Launch	***Thinking About Our Data*** Kaitlin introduces students to some of the science ideas researchers use to make sense of large data sets. Students are introduced to the idea of calculating means, and practice with an example small data set.	20 minutes	Whole class or individual
Explore	***Graphing Data & Constructing a Recommendation*** Students use SageModeler to represent data visually in a graph, and then reflect on whether the data supports or doesn't support their hypothesis. Optionally, they can also use standard deviation as a tool to think about statistical significance. Afterwards, they create a recommendation to share with Crystal Cove State Park.	30-45 minutes	Whole class or individual
Share	***Sharing Our Findings*** In a group discussion, students reflect on the trends they found in their data and share their recommendations.	20 minutes	Whole class or small groups
Extend	***Explore at Home: Creating a Presentation (Optional)*** Students design a presentation to share their findings from Project Crystal with their community, classmates, or family.	30-60 minutes	Individual
Reflect	***What is our recommendation?*** Students share their recommendation with Crystal Cove State Park and reflect on their experience during Project Crystal.	15 minutes	Individual

Implementing This Module

This module introduces ideas about graphing, thinking about data, and using evidence to support claims. The data included in SageModeler and the graphs in the Share slideshow will be updated weekly with the dataset from your week of programs, so your students should be working with the most recent dataset.

Interpreting SageModeler Graphs

SageModeler, the tool that we are using to analyze data, creates graphs that may look different from those that you have used with your students in the past. Their intent is to help students relate the visualization to the data that they collected and to reflect on its distribution. Although this is covered in the instructional videos, it will be helpful for you as a teacher to be familiar with the graph format in advance.
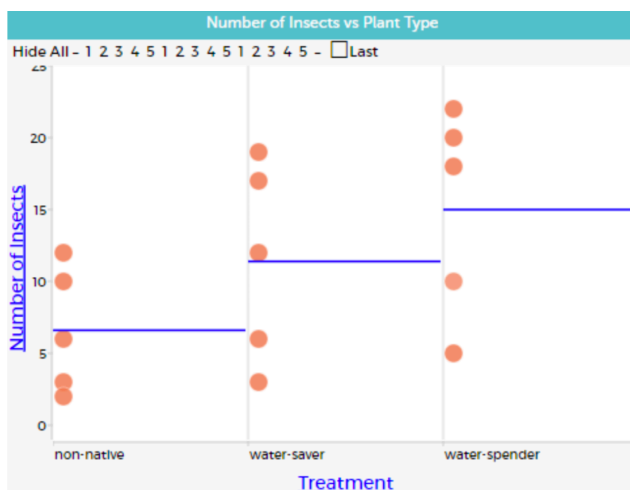
- *In the graph, the x-axis* includes the three treatments that we are comparing: water-saver plants, water-spender plants, and non-native plants.

- *The y-axis* shows what we are measuring: the number of insects counted in each sample.

- *Each individual* dot represents a single data point. In this case, each dot represents one of the soil moisture measurements that Kaitlin took at the research site.

- *The blue lines* represent the mean (or average) measurement for each treatment.

In the *Explore* section and the *Share Slideshow*, you'll find questions to help scaffold students' thinking as they begin to work with these graphs.

In addition, SageModeler's visualizations are also a good way to introduce the idea of statistical significance and variation. Representing each individual data point (instead of simply turning them into a bar like one might find in a typical bar graph) allows students to look at the distribution of data.

If data is tightly clustered together and the data points in the different treatments don't appear to overlap, it is more likely that the results are "real" rather than the result of random chance. If there is a wider variation with a lot of overlap (like you see in the above example), it is more likely that the differences are due to random chance, meaning that there may not be a real difference between the treatments.

Materials

- *Module 6 Launch Slideshow*
- *Module 6 Explore Slideshow*
- *Module 6 SageModeler Template*
- *Module 6 Share Slideshow*
- *Module 6 Explore at Home Slideshow*
- Module 6 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

Before You Start Teaching

- Copy over the over the *Share Slideshow*, and the *Explore Slideshow,* the Share Slideshow, and the Explore at Home Slideshow to your own Google Drive account.

- Decide how you want students to share their final recommendation with Crystal Cove Conservancy. Students can submit it via Google Forms, or you can share a link to their Reflect videos with us (if they are not posting them on one of our public pages).

- 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.

- The Share discussion for Module 6 is longer than in past modules. Before hosting it, take a few minutes to review the slides and the graphs.

- 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

Thinking About Our Data **(20 minutes)**
Slideshow Link

In this slideshow, students are introduced to the idea of using mathematical representations to compare different groups of numbers. They calculate the average for the insect abundance data from the three treatments, and then compare them to see if their hypothesis was supported or not supported by the data.

Explore

Graphing Data & Constructing an Explanation **(45 minutes)**
Slideshow Link
SageModeler Template Link

During the slideshow, students first use SageModeler to create graphs of the insect abundance and bird attack rate data set, and then respond to questions to reflect on the graph and determine if their hypothesis was supported or not supported. The data in the SageModeler template will be updated weekly as students collect new data, so it should be recent when your students analyze it.

As students begin working with the SageModeler graphs, you can use the following questions to help them think about what the visualization is showing:

- What are we comparing along the x-axis? What are we measuring along the y-axis?

- What does each orange dot represent?

- What does each blue line represent?

- How much variation is in our data? Are the data points clustered together tightly around the average reading (blue line) or is there a lot of variation in the data?

If you would like, there are also a series of optional slides (Slides 9-12) that introduce the idea of statistical significance directly, which students can use to determine if any differences they see are likely real or possibly the result of random variation. You can decide whether or not to include these slides for your class.

Finally, students create an explanation checklist and then use a Claim-Evidence-Reasoning format to construct a recommendation for Crystal Cove State Park.

Share

Discussion: Sharing Our Findings (20 minutes)
Slideshow Link

During this final discussion, students discuss what they found when they analyzed the data set and share their recommendation for Crystal Cove State Park. The images on the graph slides will be updated weekly throughout the spring as students collect new data, so they should reflect the data that your students have analyzed.

This discussion is an optimal time to emphasize the importance of evidence in science. When we engage in scientific discussions and research, we want to use evidence to support our claims and recommendations.

The last slide of the slideshow has a few reflection questions so that students can reflect on their experience acting as a scientist during Project Crystal.

Before diving into the Module 6 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!

Extend

Explore at Home: Creating a Presentation (30-60 minutes)
Slideshow Link

During this optional Explore at Home Investigation, students step away from the screen and design a short presentation to share their findings with their family or other community members. You can make any modifications to this activity to fit the needs of your students!

Reflect

Reflection Question: What is your recommendation for Crystal Cove State Park? (15 minutes)
Flipgrid Link
Padlet Link
Video Link

At the end of the module, students share their final recommendation about the use of mulch at Crystal Cove State Park. 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.