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 mulch they think Crystal Cove State Park staff should use.

Finally, they share their recommendation back with Crystal Cove Conservancy and (in an optional extension) with their family 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. ***Use*** 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. ***Use*** 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 that scientists use when planning an experiment. After learning about the experimental design, students set up their science journal so that they are ready for data collection.	20 minutes	Whole class or individual
Explore	***Video Field Trip: Analyzing Data*** During this optional video field trip, students are introduced to the idea of using averages and graphs to represent their data, and use SageModeler to analyze soil moisture data.	30-45 minutes	Whole class
	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 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

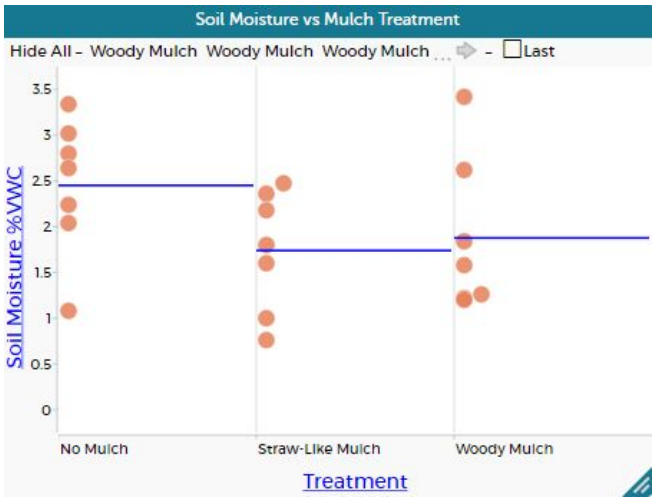
Implementing This Module

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 monthly as UC Irvine helps us collect data throughout the spring, so your students should be working with the most recent dataset.

Although the Explore section of the module is set up so students can take part individually, it will likely be challenging for them. You may want to consider using class time to go through the Explore section as a group, so that you can support students in thinking about data and using evidence.

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: no mulch, straw-like mulch, and woody mulch.
- ***The y-axis*** shows what we are measuring: the percentage of soil moisture in the soil.
- ***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.

Virtual Materials

- Module 6 Launch Slideshow: ***http://bit.ly/37Gpgp3***
- Module 6 Explore Slideshow: ***http://bit.ly/3mL06tV***
- Module 6 Explore SageModeler Template: ***http://bit.ly/3heVzyx***
- Module 6 Share Slideshow: ***http://bit.ly/38zufae***
- Module 6 Explore at Home Slideshow: ***http://bit.ly/3mL4fxC***
- Module 6 Explore at Home Family Directions (English): ***https://bit.ly/37P634R***
- Module 6 Explore at Home Family Directions (Spanish): ***https://bit.ly/3qmDIJu***
- Module 6 Reflection Video Prompt:
  - **Option 1:** Flipgrid: ***http://bit.ly/37GqIrv***
  - **Option 2:** Padlet: ***http://bit.ly/2M56NdB***
  - **Option 3:** Video to host on the private platform of your choice: ***http://bit.ly/38v7F2G***

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 whether you want students to take part in the Explore section individually, or if you will present it to the entire class. If you have time in class, we highly encourage going through the slideshow all together.

- Decide how you want students to analyze the plant data. If you are short in time, we recommend assigning students to analyze the data from one of the two plant species. Open your copy of the ***Explore Slideshow*** and update ***Slide 7*** with the specific instructions.

- 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: ***http://bit.ly/37Gpgp3***

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 soil moisture data from the three treatments, and then compare them to see if their hypothesis was supported or not supported by the data.

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

Video Field Trip (30-45 minutes)

During this virtual field trip, students are introduced to the SageModeler platform and how to use it to create graphs and look for trends.

You can schedule a Video Field Trip program for your class with us at a time that is convenient for you, or have your students join a public livestream on YouTube, which will be scheduled quarterly. All public livestreams will also be available afterwards to watch asynchronously. Contact Kaitlin Magliano at ***kaitlin@crystalcove.org*** to schedule your Video Field Trip.

Graphing Data & Constructing an Explanation (45 minutes)

Slideshow Link: ***http://bit.ly/3mL06tV***
SageModeler Link: ***http://bit.ly/3heVzyx***

Although this Explore section is designed so that students can go through it individually, we highly encourage you to consider going through it as a whole class, especially if you choose not to schedule a video field trip. This will allow you to support students through the process and give them a chance to share their thinking after each step.

During the slideshow, students first use SageModeler to create graphs of the soil moisture and plant growth 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 monthly as we 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: ***http://bit.ly/38zufae***

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 monthly throughout 2021 as we 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: ***http://bit.ly/3mL4fxC***
Family Directions (English): ***https://bit.ly/3oKyMxA***
Family Directions (Spanish): ***https://bit.ly/3qmDIJu***

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: ***http://bit.ly/37GqIrv***
Padlet Link: ***http://bit.ly/2M56NdB***
Video Link: ***http://bit.ly/38v7F2G***

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.