

Focus: Defining the Problem

Grade Level: 7-12

Session Length: One or two sessions of 45-60 minutes

Driving Questions

- How is sand volume on the North Beach changing over time?
- How can we use the data to validate the ideas in our model?

NGSS Links

- Analyzing and Interpreting Data
- Using Mathematics and Computational Thinking

In the seventh session of the Coastal Dynamics Program, students project teams graph the data they collected through the virtual data collection exploration in Session 5. They then use their graphs to look for patterns and correlations between the different factors.

During the first part of the session, students use SageModeler to create a line graph showing how the sand volume on the North Beach changed over time. After creating the graph, students look first for seasonal trends, and then add a trendline to the graph to see if the area is gaining or losing sand. Next, students add other factors to their graph to look for correlation between the different data sets. Finally, they use this data to test the assumptions in their model and update their model to match what they noticed in the data.

Learning Outcomes & Assessments

<i>By the end of this module, students will be able to...</i>	<i>You can assess this using...</i>
1. Use SageModeler to create a line graph of a data set with a trendline.	Observations of student graphs in SageModeler; Class discussion
2. Analyze a graph to look for seasonal change and trends over time.	Class discussion; Field notebooks
3. Compare two line graphs to look for correlation between different data sets.	Class discussion; Field notebooks
4. Update their computational model based on real-world data.	Student models; Field notebook reflection

Session Overview

Section	Description	Length	Format
Launch	Erick welcomes the students to Session 7 in a short video and explains that they will analyze the data they collected in Session 5.	5 minutes	Whole class
Explore	Students use SageModeler to create a line graph showing how the sand volume on the North Beach changed over time, analyze the graph for trends, compare two line graphs, and update their computational model based on their analysis of their data.	30-45 minutes	Project teams
Share	Students share their analysis of their data with their classmates and discuss the implications of their data on their predictions and models.	5-10 minutes	Whole class
Reflect	Students reflect on their experience during Session 7.	5 minutes	Individual

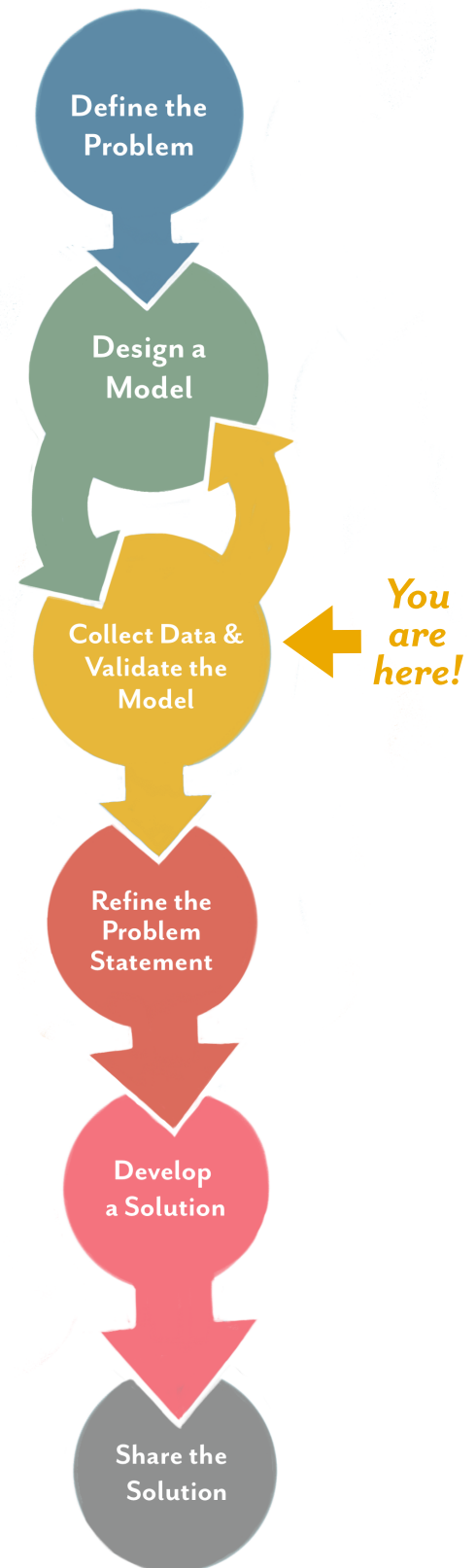
The Environmental Engineering Process: Validate the Model

In Session 7, students continue analyzing the beach profile data that they collected by graphing their data sets to look for trends and then checking for correlations between different data sets. Afterwards, they use any correlations that they've noticed to validate the ideas in their model.

In this lesson, students use their data as evidence to check the initial ideas in their model. By doing so, they will be able to check whether their predictions about the relationships between different factors were correct. This will position them to update their model as needed.

That being said, it is likely that some of the data sets will be inconclusive – students may not be able to determine whether the trendlines are strongly correlated. Instead, they may determine that there is not a very strong relationship between different factors or may decide that more data is needed to see if a stronger correlation emerges over time.

Throughout Session 7, remind students that the reason that we collected data is to validate the models that we created earlier. The patterns that they find in their data can be used as evidence to support the claims in their model about how different factors affect beach sand over time. Once they check their model, they'll be able to return to the problem statement that they created in Session 1 and describe how the sand volume on the North Beach is changing over time.



Virtual Materials

- [Session 7 Google Slides Presentation](#)
- [Session 7 Field Notebook Template](#) (optional)

Each student will need...

- A device with internet access (a computer, smartphone, or tablet will all work!)
- Their project team's model from Session 2
- Field notebook and pencil

Before You Start Teaching

- Copy over the [Session 7 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.)
- Decide how long to give students for this session. If data analysis is new to them or if your class meetings are short, you may want to plan to break Session 7 into two meetings.
- Take a few minutes to review the screencasts provided within the Google Slides. Most of the session should be self-guided for students, but you can check to see if there are any parts where you may need to offer specific assistance.
- Consider whether you want students to work independently or in groups for this session. It may be helpful to have students work in pairs if possible. This will allow them to actually manipulate the computer instead of simply watching, but will also give them a buddy to help support them if they struggle with creating the line graphs.

Learning Sequence

Launch

Introduction to Session 7 (5 minutes)

1. Open the [Session 7 Slideshow](#) and play the video on [Slide 2](#) for your class. In this video, Erick will introduce the the data analysis they will be doing during Session 7 and how they will use that analysis to update their model.
2. After watching the video, advance to [Slide 3](#), where you will find a graphic of the environmental engineering process with a marker pointing at “Collect Data & Validate Model.” Tell students that today, they will continue on this step within the Environmental Engineering Process by analyzing the data that they collected so that they can use it to validate the assumptions in their model.
3. Once you’ve gone over this step in the engineering design process, advance to [Slide 4](#) to give students an overview of what they will do and learn during Session 7.

Explore

Analyzing Data (30-45 minutes)

1. Advance to [Slide 5](#) and play the video that shows a screencast of how to create a line graph in SageModeler.
2. Once the screenshot is finished, move on over to [Slide 6](#). This slide provides written instructions for how to create a line graph in SageModeler. Give students time to work on creating their line graph. Walk around the room to monitor progress and provide assistance when necessary.
3. Once students have completed creating their graphs, advance to [Slide 7](#) and play the video. Erick will ask the students to take a close look at their graph and look for seasonal trends in sand volume.
4. After playing the video, move on to [Slide 8](#). This slide provides guiding questions that will help students look for seasonal trends in their graph. Walk around the room to monitor progress and provide assistance when necessary.
5. Once students have finished identifying any seasonal trends, advance to [Slide 9](#). Play the video that is a screencast for how to add a least squares line to the graph.

6. Move on to *Slide 10*, which provides written directions for how to add a least squares line to the graph. Walk around the room to monitor progress and provide assistance when necessary as students add a least squares line to their graph.
7. Once students have finished, advance to *Slide 11*. Play the video of the screencast that will help students use SageModeler to reflect on their data.
8. After playing the video, move on to *Slide 12*. This slide provides written instructions to help students interpret their data. Walk around the room to monitor progress and provide assistance when necessary.
9. Once students have finished interpreting their data, advance to *Slide 13*. Play the video of the screencast that explains how students can use SageModeler to define relationships between the variables and sand volume.
10. Move on to *Slide 14*, which provides written instructions to help students record the relationships that they identified.
11. Once students have finished recording the relationships they identified, advance to *Slide 15* and play the video. Erick will explain how the students will now look at their model and decide if the data they analyzed indicate that they need to make revisions to the assumptions that they included in their model.
12. After playing the video, move on to *Slide 16*. This slide provides written instructions to help students decide whether they need to revise their model based on their data analysis. Walk around the room to monitor progress and provide assistance when necessary.

Share

Sharing Our Model Updates (5-10 minutes)

1. Once students have finished updating their models or explaining why they do not need to update their model, advance to *Slide 17*. This slide provides questions that can be used by each group to share their data analysis and how it impacted their model with their classmates.

- What trends did you observe in your data? Were there any correlations between sand volume and any wave characteristics?
- Where your original predictions on what might cause sand volume to increase or decrease supported or not supported?
- Did you make any changes to your initial model? Why or why not?

Reflect

Reflecting on Session 7 (5 minutes)

1. At the end of the discussion, advance to *Slide 18* in the slideshow and play the video, where Erick will recap the experience today and ask students to spend a few minutes reflecting.

2. Move on to *Slide 19*, which will share reflection questions. Ask students to spend five minutes reflecting on their experiences today in their field notebook.

3. Finally, thank the class for their time today. Tell them that when you gather again, they will they will refine the problem statement.