Lesson Planning Guide

Develop Lesson Plans for Instruction

Steps in developing NGSS-/standards-aligned, phenomenon-based lessons that are guided by the 5Es instructional model:

1. Complete the Lesson Plan Overview (Part A) to guide development of lesson plans.
2. Use the Lesson Plan Template (Part B) to create detailed lesson plans.

Lesson Overview Template (Part A)

1.a Select grade level NGSS Performance Expectations (PEs) or Topics, or district/state standards that support lesson-based student learning goals.
For NGSS, PE color coding reflects its 3-dimensional learning components. Search the Evidence Statements for details on what students should know and do.

Middle School 7th Grade Science, to take place at Santiago Middle School in Orange, California.

MS-ESS2-3 Earth's Systems: Analyze and interpret data on the distribution of fossils and rocks, continental shapes, and seafloor structures to provide evidence of the past plate motions. Examples of data include similarities of rock and fossil types on different continents, the shapes of the continents (including continental shelves), and the locations of ocean structures (such as ridges, fracture zones, and trenches.)

1.b Identify a lesson-based anchoring phenomenon that builds towards understanding of the PEs/standards, and is engaging and relevant to students.
See more about phenomena and using phenomena with NGSS.

Anchoring phenomena: Volcano, sand, plate tectonics

1.c Ask a Driving Question, which is authentic and student-focused, that relates to investigating the PEs/standards and phenomenon.
See more about Driving Questions and using Driving Questions with NGSS.

How is the Santiago Creek sand eroded from the Santiago Peak Volcano similar to or different from sand samples from around the world?

1.d Unpack the 3-D learning components of the Performance Expectations/standards in the table below.
For NGSS guidance, see the NGSS Topic Arrangements and NGSS DCI Arrangements. Use tools to unpack each PE separately.

Science and Engineering Practices (SEP) (skills)	Disciplinary Core Ideas (DCI) (content)	Crosscutting Concepts (CCC) (connections)
Analyzing and Interpreting Data: Analyze and Interpret data to provide evidence for phenomena. Students will analyze and interpret data from the Science of Sand website in provide evidence of plate tectonics and associated volcanism.	**ESSC2.B Plate Tectonics and Large-Scale System Interactions: Maps of ancient land and water patterns, based on investigations of rocks and fossils, make clear how Earth's plates have moved great distances, collided, and spread apart.** Use maps to explore how subduction caused the Santiago Peak Volcanics and compare to maps of other volcanoes.	**Patterns: Patterns in rate of change and other numerical relationships can provide information about natural systems** Explore the different rates of change and geological timeframes among the different sand samples.

1.e Determine students' prior knowledge about the lesson concepts. (e.g., pre-test, class discussion, exit ticket, 1-minute report, KWL chart, survey, etc.)

Engage students in a class discussion based on the Rock/Water Cycle Analogy Graphic Organizer comparing the rock cycle to the water cycle. The students studied the water cycle in the unit prior to this one.

1.f Identify Lesson Topics and Learning Goals: List main lesson concepts related to grade level PEs/standards that support student learning goals in figuring out the anchoring phenomenon; revise as needed.

1. Students will build on their understanding of the prior unit, the water cycle, as they begin to learn about the rock cycle.
2. Students will be able to read maps associated with the different tectonic processes.
2. Students will understand the tectonic history of the extinct volcano behind the school.
3. Students will understand how the eroded crystals (sand) from Santiago Peak compare with sand samples from elsewhere in the world.

1.g Select Lesson Resources: Identify resources to develop lessons that address the PEs/standards and investigate the anchoring phenomenon through a variety of sequenced activities; revise as needed (include title and URL).

Resources needed:
Analogy Graphic Organizer: Rock and Water Cycles
Sand sample from Santiago Creek
Electron Microgram of sand sample from Santiago Creek
Science of Sand website: https://www.scienceofsand.info/
Rocks to manipulate

Lesson Plan Template (Part B)

Grade and Subject	7th Grade Science, Santiago Middle School, Orange, California	**Instructional Time** (min.)	45 minutes
Lesson Title (Topic)	The Rock Cycle, Plate Tectonics, and Volcanoes (Week-long Unit that immediately follows a prior week-long unit on The Water Cycle)		
Anchoring Phenomenon (copy from 1.b)	Anchoring phenomena: Sand and Volcanoes		
Driving Question (copy from 1.c)	How is the Santiago Creek sand eroded from the Santiago Peak Volcano similar to or different from sand samples from around the world?		

Lesson Overview	
Lesson Summary (description)	**Lesson Topics and Student Learning Goals** (copy from 1.f)
Teacher will assess prior knowledge and introduce concepts of the rock sample and plate tectonics using class discussion, the Water/Rock Cycle Analogy Graphic Organizer, and rocks for students to manipulate. Teacher will introduce the sand sample from Santiago Creek, the electron micrograph of the sand sample, the map of Santiago Peak Volcanics, the Science of Sand website, description of 4 other domestic and international sand samples, and a basic overview of volcanoes and plate tectonics. Students will begin their week-long lab group Sand Sample project by selecting the sand sample from the Science of Sand website that they want to compare to the Santiago Creek Sand Sample. Students will end the lesson by completing a Quick Write on what they have learned.	1. Students will build on their understanding of the prior unit, the water cycle, as they begin to learn about the rock cycle. 2. Students will be able to read maps associated with the different tectonic processes. 3. Students will understand the tectonic history of the extinct volcano behind the school. 4. Students will understand how the eroded crystals (sand) from Santiago Peak compare with sand sample from elsewhere in the world.

Lesson Resources Aligned with Standards	
Lesson Resource (copy from 1.g, sequenced with titles and links)	**Resource Standards Alignment** (copy from 1.d, standards notated, link optional)
Analogy Graphic Organizer: Rock and Water Cycles	**Analyzing and Interpreting Data: Analyze and Interpret data to provide evidence for phenomena.** **ESSC2.B Plate Tectonics and Large-Scale System Interactions: Maps of ancient land and water patterns, based on investigations of rocks and fossils, make clear how Earth's plates have moved great distances, collided, and spread apart.**
Sand sample from Santiago Creek	**ESSC2.B Plate Tectonics and Large-Scale System Interactions: Maps of ancient land and water patterns, based on investigations of rocks and fossils, make clear how Earth's plates have moved great distances, collided, and spread apart.**
Electron Microgram of sand sample from Santiago Creek	**Analyzing and Interpreting Data: Analyze and Interpret data to provide evidence for phenomena.** **ESSC2.B Plate Tectonics and Large-Scale System Interactions: Maps of ancient land and water patterns, based on investigations of rocks and**

	fossils, make clear how Earth's plates have moved great distances, collided, and spread apart. **Patterns: Patterns in rate of change and other numerical relationships can provide information about natural systems**
Science of Sand website https://www.scienceofsand.info/	**Analyzing and Interpreting Data: Analyze and Interpret data to provide evidence for phenomena.** **ESSC2.B Plate Tectonics and Large-Scale System Interactions: Maps of ancient land and water patterns, based on investigations of rocks and fossils, make clear how Earth's plates have moved great distances, collided, and spread apart.** **Patterns: Patterns in rate of change and other numerical relationships can provide information about natural systems**
Rocks to manipulate	**ESSC2.B Plate Tectonics and Large-Scale System Interactions: Maps of ancient land and water patterns, based on investigations of rocks and fossils, make clear how Earth's plates have moved great distances, collided, and spread apart.**

Teacher Preparation	
Student Misconceptions (potential student ideas that are problematic when engaging in the lesson)	**Scientific Terminology** (vocabulary named once students "figure out" concepts of lesson)
Students struggle with the idea that rocks have not always been like they are now. Students find it hard to believe that the area around their school and homes is an extinct volcano. Students struggle with the concept of plate tectonics.	**Igneous rock** **Sediments** **Sedimentary rock** **Metamorphic rock** **Magma**

Materials Preparation		
Student Needs (activity sheets, data packet, etc.)	**Group Needs** (lab equipment, group data packets, etc.)	**Safety & Technology Needs** (unsafe materials, websites cued, etc.)
Chromebook Rocks Analogy Graphic Organizer	Santiago Creek sand Sample Science of Sand website Geological map of area	Science of Sand website cued

Supporting Information	
References (links to cite sources of data, images, websites, etc.)	**Background Reading** (for teachers and/or students)
Science of sand website Geological map of area	Textbook on the rock cycle and plate tectonics Analogy Graphic Organizer

Complete the 5E Instructional Model section(s) that are relevant to the lesson:

Engage: ***Interest in a concept is generated and students' current understanding is assessed.***

ACTIVATE interest: Introduce anchoring phenomenon and driving question.

- Engages students in the concepts through a short activity or relevant discussion
- Connects students' past and present experiences
- Creates interest and generates curiosity
- Uncovers students' current knowledge and misconceptions
- Initiates students' investigation into the anchoring phenomenon based on an observation, problem, or question

Phenomenon-based Driving Questions (questions students are likely to ask about the lesson topic)

How can we be living on a volcano?
How can sand from our local dry creek bed be eroded from a volcano?
How can sand from other parts of the world be similar to ours?

Lesson Activities (experiment, demonstration, video, visualization, reading, etc., coherently sequenced to help build understanding of PE/standard)
For each activity, provide details of the procedure including timing, teacher guidance, student prompts, strategies for discussions and differentiation, etc.

1. Students will engage in a brief class discussion using the Water/Rock Cycle Analogy Graphic Organizer as a basis for the teacher to assess the students' understanding of the basics of the Rock Cycle and Tectonic Processes.
2. Teacher will hand out a variety of different types of rocks for students to manipulate during the lesson. Students will be asked to discuss in small groups several questions: 1) Do you think these rocks always were the same as they are now? 2) Where do you think these rocks came from? 3) How would you figure that out?

3. Teacher will provide a sand sample from Santiago Creek for each lab group.
4. Teacher will project the Santiago Creek Sand Sample and map of Santiago Peak Volcanics on the wall for use during the activity.
5. Teacher will provide preliminary brief direct instruction on volcanoes, plate tectonics, and the geological history of Santiago Peak. Teacher will use the Science of Sand website as a resource in this instruction. Teacher will use samples from Mt. Hood, Giardini Naxos, Solheimajokull Glacier, and Guana River State Park to demonstrate how to do the exercise.
6. Students will begin the Science of Sand Sample project that they will be working on all week. Today, each lab group will use their school-provided chromebook to identify one sample from the Science of Sand website (other than the sand samples used by the teacher in the demonstration) that they would like to study. Half of the students will select a domestic sample, while the other half will select an international sample.

Formative Assessment (activity sheet, Venn diagram, summary, exit ticket, think-pair-share, etc. to check for understanding of lesson concepts)

Students will answer the following question as a Quick-Write at the end of the class session: How is it possible that the sand from Santiago Creek could contain remnants of an extinct volcano?

Consensus Discussion (claims, evidence, and reasoning on what students figured out in this lesson)

Opening discussion on the similarities and differences between the water and rock cycle using the Analogy Graphic Organizer (#1 above).
Discussion on the rock that each student has been provided (#2 above).
Lab group discussion to select the Science of Sand sand sample to be used for the activities for the rest of the week (#6 above).

New Questions and Next Steps (student-driven questions, ideas on what to investigate in the next lesson and how to investigate it, etc.)

Student-driven Questions:
How is the Santiago Creek sand like the sand sample we picked on the Science of Sand website?
How are we going to figure out how the Santiago Creek sand is similar to and different from the sand sample we picked from the Science of Sand website?
How does plate tectonics make this all work?
What does any of this have to do with the Rock Cycle?
Lessons for the rest of the week:
Over the next 4 days, students will research their selected sand sample and compare it to the Santiago Creek sand sample. Other lessons this week will be focused on helping the students to understand the Rock Cycle. At the end of the week on Friday, each lab group will present their findings to the rest of the class.