Career Connections Exploration (CCE) 2:
Volcanologist/Earth Scientist - Teacher Guide

Learning Time: 2 - 50 minute class periods

Instructional Setting:

- Home, online, classroom

Career Connection Exploration Questions:

- How do volcanologists make use of NASA tools?
- Which careers depend on volcanologists' ability to interpret NASA data?

Learning Performances:

- Students interpret data from a NASA tool and apply it to careers related to (or reliant upon) volcanology
- Students use their own experiences to identify other careers or times in their own life where the NASA tool may be helpful

NGSS Connections:

Disciplinary Core Ideas (DCI) *Students build towards
ESS2.A: Earth's Materials and Systems **ESS3.B: Natural Hazards**

Student Activity	**Option 1:** Volcano Hunter	**Option 2:** Vesuvius	**Option 3:** MODVOLC	**Option 4:** Earth Observatory
Science and Engineering Practices (SEP)				
Analyzing and Interpreting Data	X	X	X	X
Developing and Using Models			X	
Cross Cutting Concepts (CCC)				
Patterns	X		X	X
Stability and Change	X	X		X
Energy and Matter	X	X	X	X

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Cause and Effect	X	X	X	X
Scale, Proportion, and Quantity	X	X	X	X

Introduction:
Students do not need any prior experience to do this Career Connection Exploration (CCE). This CCE covers the NGSS Science and Engineering Practices (SEPs) listed in the table above and provides students with practice thinking about the Nature of Science principle "Science is a way of knowing; Science investigations begin with a question" (Next Generation Science Standards 2018).

The purpose of this CCE is to allow middle school students to "pull the curtains back" on a STEM career that relies on NASA-related resources (e.g., satellite data) and explore NASA-generated data. The activity does not require parent supervision or additional resources to complete, and can be done in the classroom or at home. In addition, this could be used as material for absent students, as class material to leave with a substitute teacher, or as supplementary material to help build student understanding of potential career options.

Advanced Preparation

- Prepare copies of the appropriate Student Activity Guide as needed.

Teaching Resources

- Google tool for struggling students - Text-to-speech extension for struggling readers

Phase 1: Introduction

- Students are introduced to the CCE they will be exploring.

Example introduction:

Everyone on Earth is affected by volcanoes. Even if you don't live on the slopes of a volcano, volcanic eruptions create hazards from ash fallout, gas emissions, earthquakes, and landslides in the surrounding regions. Further away, drifting clouds of ash particles and gases create "no-fly zones" for aircraft, and their deposits affect agriculture and air quality for hundreds to thousands of miles. Large eruptions even affect world climate, by putting materials into the atmosphere that can last for years and affect global temperatures. A career in volcanology combines an interest and awareness of the natural world, use of advanced satellite, ground-based, and laboratory technology, and the ability to work with people. Because volcanic

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activity is so difficult to predict and can be so dangerous, volcanologists are on the front lines when it comes time to order evacuations, declare safe and unsafe areas, and help guide rescue and relief efforts.

In this Career Connection Exploration your task is to read about what it is like to be a volcanologist and the types of NASA tools/data that are used to study volcanoes. You will then do an activity that will let you experience some of the tools that volcanologists use. Finally, you will spend some time thinking about what other types of careers might rely on the work of volcanologists.

- Students "vote with their feet'' regarding whether or not they would like to become a volcanologist. They go to the eastern side of the classroom if they would like to become one, to the western side if they would not, and the northern side if they are not sure.

Phase 2: Day in the Life

Gather Information

- Students are presented with a "A day in the life of a volcanologist" narrative that is derived from an interview with Lizzette Rodriguez, a professor at University of Puerto Rico who studies volcanoes. This short reading introduces students to the day-to-day activities and responsibilities related to volcanologists.
    - Student Resources
        - CCE2_DayInTheLife_Student_Volcanologists

Reading Strategy Teacher Note: As students read through the narrative, it may help for them to write down whatever comes to mind. Example prompts include:

- What would you say to the author if you were having a conversation?
- What questions do you have?
- What does the text remind you of or make you think of?

If working with individual paper copies, students may want to use colored pencils to highlight different components. If working with shared text copies, students can make their notes on a separate piece of paper or in their science journal. If working electronically, Kami is an extension available in Google Chrome that provides students with a variety of useful tools to annotate text electronically.

Analyze Information

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- After reading the narrative, students work in pairs to display their thinking by answer questions in the following graphic organizer:
    - CCE_DayInTheLife_Student_GraphicOrganizer

Communicate Information

- The class comes together and discusses their answers to the questions above. Students look for similarities and differences in how they interpret the narrative.

Phase 3: Try it Out!

Gather Information:

- Students complete an activity using data from a volcanology tool in one of the options below. There are several ways this could be done depending on your classroom needs:
    - You could pick one option for all students to complete
    - Students could pick the option they are most interested in
    - You could set up stations and all students could work through all the options

Name	Time to complete	Guides	Description
Option 1: Volcano Hunter	1-2 hrs	Student Teacher	Students investigate where volcanoes occur and how NASA satellites help study and monitor volcanoes around the world by tracking volcanic gas emissions.
Option 2: Vesuvius	1-3 hrs	Student Teacher	Students watch a PBS NOVA documentary on the 79 A.D. eruption of Vesuvius and answer questions related to the event.
Option 3: MODVOLC	1 hr - many days	Student Teacher	Students use the MODVOLC website to collect information about volcanic eruptions.
Option 4: Earth Observatory	1-2 hrs	Student Teacher	Students use the NASA Earth Observatory website to compare satellite images of a series of volcanic eruptions.

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- After completing their guide, students reflect on their experience working with the tool using questions similar to the following:
    - How might a volcanologist use these tools as evidence for their volcanic activity forecast?
    - How might these NASA tools be helpful to people in some other careers besides volcanologist?
    - How might these NASA tools be helpful to you?

Communicate Information:

- Students come together as a class to discuss their experiences with the NASA tool and their answers to the three questions above.

Phase 4: Mind Mapping

- Students work in small groups and consider other careers related to or dependent on meteorology by developing a mind map.
    - Student Resources
        - CCE2_MindMapping_Student
    - Teacher Resources
        - CCE2_MindMapping_Teacher

- The class comes together to compare their individual mind maps, and develop a whole-class mind map.

- Students once again “vote with their feet'' regarding whether or not they would like to become a meteorologist.

- Students pair up with a partner to individually discuss why they voted the way they did. Students share their responses with the class.

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