Lesson Overview

Students’ Initial Explanations

In this lesson, students are introduced to the unit and to their roles as geologists exploring a fossil that was discovered in a rocky outcrop in Desert Rocks National Park. Students write their initial explanations about how the fossil got into the rock and consider how they could use the fossil and the rocky outcrop to learn about what Desert Rocks National Park was like in the past. The explanations students provide in this lesson serve as a Pre-Unit Assessment for formative purposes, designed to reveal students’ initial understanding of some of the unit’s core content, both unit-specific science concepts and the crosscutting concept of Stability and Change, prior to instruction. As such, students’ explanations offer a baseline from which to measure growth of understanding over the course of the unit. These explanations can also provide the teacher with insight into students’ thinking as they begin this unit. This three-dimensional assessment will allow the teacher to draw connections to students’ experiences and to watch for preconceptions that might get in the way of students’ understanding. After the Pre-Unit Assessment, students are invited to share what they already know about rocks and fossils. Students also explore the Earth’s Features Simulation, a digital tool that allows them to model the creation of rock layers and fossils over time. The purpose of this lesson is to frame the Earth’s Features unit for students and to offer them an opportunity to express their initial ideas about rocks and fossils.

Anchor Phenomenon: A rocky outcrop in Desert Rocks National Park has a fossil in it.

Students learn:

- A geologist is a scientist who studies the materials and processes that form the solid part of Earth.
- Rocks and fossils can provide clues about the way Earth changes over time.
- Reflecting on what you understand and don’t understand allows you to prepare for learning new things.
Exploring the Earth’s Features Simulation

Students explore the *Earth’s Features* Simulation to learn about its functionality. They also receive their Investigation Notebooks.

**Instructional Guide**

1. **Introduce Investigation Notebook and its purpose.** Hold up a copy of the *Earth’s Features* Investigation Notebook. Let students know that scientists use notebooks in many ways, including to keep track of what they observe. They draw what they observe and record what they have learned.

2. **Distribute Investigation Notebooks.** Distribute one notebook to each student. Give students a moment to look through their notebooks.

3. **Review Safety Guidelines for Science Investigations.** Have students turn to page 1 in their notebooks and read along as you review each safety guideline.

4. **Project *Earth’s Features* Simulation** and explain its purpose.

   Geologists use different tools to learn about how Earth changes over time. We’re going to use a digital tool throughout the unit called the *Earth’s Features* Simulation. The Simulation will help you observe changes that happen over very long periods of time.
5. **Project Guidelines for Using Apps.** Introduce students to the expectations for using apps and digital devices in the classroom.

### Guidelines for Using Apps

- Only one person “drives” at a time.
- Anyone can make suggestions about how to use the app.
- Talk about what you observe.
- Rotate the role of “driver.”

6. **Explain that students will have a chance to explore the Sim.** Invite students to turn to page 3 in their Investigation Notebooks. Read aloud the instructions.

   - With your partner, explore the *Earth’s Features* Simulation.
   - Talk about the discussion questions with your partner as you observe what happens in the Sim.

   Read the discussion questions aloud.

   - What happens when you move time forward?
   - How are the three locations different from one another?
   - When you change the sea level, what do you observe happening?
   - After you have finished exploring the Sim, record your response to the question.

   Read the question aloud.

   - What new questions or ideas do you have about rocks and fossils?

7. **Distribute digital devices.** Distribute one digital device to each pair of students and have them access the *Earth’s Features* Simulation via the **Student Apps Page**. Let students know they will have about 10 minutes to explore the Simulation.
8. **Circulate and assist students.** Encourage students to discuss what they are observing with their partners. Listen for student questions and observations about the Sim. After 5 minutes, provide a signal for partners to switch “drivers” if they have not done so already.

9. **Collect digital devices.**

10. **Project the Simulation again and lead a debrief.** Discuss features of the Sim. Students are very quick to learn on their own and will be more engaged if they can discover and share some of the Sim’s features. Demonstrate, or allow students to demonstrate, what they discovered about how the Sim works. Point out the following features students can manipulate if they don’t bring them up in the discussion:

    - **Three locations.** Three locations are marked on the large zoom-out. Location 1 is the highest, location 2 is below that, and location 3 is the lowest.
    - **Zoom-ins.** There are three zoom-in images that show what below Earth’s surface looks like in the three different locations.
    - **Sea-level slider.** Adjusting the sea-level slider changes sea level and changes the environments in all three locations.
    - **River speed.** Adjusting the river speed changes the environment between a beach and a river delta and causes the floodplain to flood or drain.
    - **Time controls.** Time can be moved forward or backward by 10,000 years, as indicated on the timeline, using the time controls at the top of the screen.
    - **Resetting.** You can reload the mode you are on by pressing RESET.

11. **Conclude the lesson.** Connect the Simulation to students’ roles as geologists. Explain that students will work with the Sim many times during the unit, and that it will help them investigate how places on Earth change over time.

**Teacher Support**

**Background**

**Science Note: About the Earth’s Features Simulation**
The *Earth’s Features* Simulation allows students to see the processes of rock and fossil formation through the accumulation and compression of sediment over time. The Simulation is a dynamic model that shows how sediment accumulates in different environments, leading to the formation of different rock layers in those environments. It also models the formation of different kinds of fossils in different environments. Open exploration in the Simulation enables students to begin to get a sense of how rocks and fossils form at the outset of the unit. This will prepare students to be able to use the Simulation in later lessons as evidence in support of claims about rock formation in various environments.
Rationale

Pedagogical Goals: Exploring the *Earth’s Features* Simulation
The first time students use the Simulation, they need a few minutes to freely explore the Simulation’s features. Students are generally quite facile in discovering Simulation features independently or with a partner. This type of open-ended exploration serves many important purposes. Use of simulations in the classroom provides time for student exploration, which enhances student interest, as well as provides students with the opportunity to share their thinking and learn from their peers. Giving students this exploration time initially reduces distraction in later Sim activities that have more focused goals.

Instructional Suggestion

Classroom Management: Sharing Digital Devices
Throughout this unit, pairs share digital devices. We recommend that instead of working individually, students work with partners so they can engage and talk to each other while investigating in the Simulation. Establish clear expectations for the use, handling, and storage of digital devices in order to decrease transition time between activities as well as to minimize any potential conflict that could come from sharing a limited number of devices.

Possible Responses

What students should do and notice:
By exploring and sharing what they notice in the Sim, students become familiar with its features.

What new questions or ideas do you have about rocks and fossils?
Answers will vary.
Image Credits
Phil Degginger/Carnegie Museum/Science Source; Shutterstock (Pre-Unit Writing: Explaining the Rocky Outcrop copymaster); Shutterstock; Harry Taylor/Dorling Kindersley/Science Source; Phil Degginger/Carnegie Museum/Science Source; wellsie82/Moment/Getty Images (Earth's Features Investigation Notebook).
Exploring the *Earth’s Features* Simulation

1. With your partner, explore the *Earth’s Features* Simulation. Observe carefully how the rock layers in the Sim can change.
2. Talk about the discussion questions with your partner as you explore the Sim.
3. After you have finished exploring the Sim, record your response to the question on the lines below.

Discussion Questions

- What happens when you move time forward?
- How are the three locations different from one another?
- When you change the sea level, what do you observe happening?

What new questions or ideas do you have about rocks and fossils?

___________________________________________________________________

___________________________________________________________________

___________________________________________________________________

___________________________________________________________________

___________________________________________________________________
**Explorar la simulación Características de la Tierra**

1. Con tu compañero/a, explora la simulación *Características de la Tierra*. Observa con atención cómo pueden cambiar las capas de roca en la simulación.
2. Habla sobre las preguntas de discusión con tu compañero/a mientras exploras la simulación.
3. Después de explorar la simulación, apunta tu respuesta a la pregunta en las líneas debajo.

**Preguntas de discusión**
- ¿Qué sucede cuando mueves el tiempo hacia delante?
- ¿De qué manera son diferentes una de otra las tres ubicaciones?
- Cuando cambias el nivel del mar, ¿qué observas que sucede?

¿Qué nuevas preguntas o ideas tienes acerca de las rocas y los fósiles?

___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________

© 2018 The Regents of the University of California. All rights reserved.