**Williamson Fellows Lesson Planning Template**

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| **Grade(s):** *What grade level(s) is this lesson appropriate for?* 6-8 | **Topic:** Geologic History of Utah | **Lesson #** \_3\_\_\_ **in a series of** \_3\_\_\_ **lessons** |
| **Brief Lesson Description**: *Briefly describe what this lesson is about, what will happen throughout the lesson, and how the lesson fits into the bigger module.*In this lesson, students will learn how can we use sedimentary rocks and stratigraphy to learn about Utah’s past. Using skills learned in previous lessons, students will study sedimentary rock sequences from national parks in the Colorado Plateau to tell the story of Utah from 500 million years ago to now. After discussing the importance of the Colorado Plateau, students will go on a virtual field trip with 4 stops at national parks. At each stop, the student will make observations about the identified rock formation(s), including grain size, fossils, and sedimentary features, then use those observations to interpret the depositional environment of each formation. The provided handout will guide these observations and interpretations. Once each stop has been visited, students will describe the geologic evolution of Utah from 500 million years ago to present. This lesson is the culmination of the module, and students should be able to draw on skills learned in the previous lessons to complete this activity. |
| **Learning Outcome(s):** *List 3-6 learning outcomes. These are the big things that a student should* ***know*** *and/or* ***be able to do*** *by the end of the lesson.*SWBAT:1. Use their knowledge of sedimentary rocks to identify depositional settings
2. Use stratigraphic principles to make a time-ordered history
3. Interpret a geologic history of Utah based on the rock record
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| **Background Information**  |
| *Provide necessary background information about ideas or concepts that students need to know* ***before*** *beginning this lesson (e.g., students should know that CO2 is a major greenhouse gas, or students should understand the role that water plays in weathering and erosion, etc.). You may want to describe why these ideas are important.*Students should understand that sedimentary rocks form in specific environments, and how to diagnose depositional environmentsStudents should understand stratigraphic principles based on the previous lesson |
| **Science & Engineering Practices:** *List up to three Science & Engineering Practices that students will engage in during this lesson.*Analyzing and interpreting dataMaking an argument from evidence | **Disciplinary Core Ideas:** *List up to three Disciplinary Core Ideas that are addressed in this lesson.*ESS2: Earth’s Systems | **Crosscutting Concepts:** *List up to three Crosscutting Concepts that are addressed in this lesson.*Stability and changeCause and effect |
| **Possible Preconceptions/Misconceptions:** *Identify any common misconceptions that students might have about the subject. For example, students often think that the only source of carbon is the atmosphere, or that scientists disagree on the causes of climate change, or that the amount of water on the planet is declining due to climate change, or that all rocks with layers are sedimentary, etc.*Students may not fully understand how environments can change through geologic time Students will likely be unfamiliar with stratigraphic columns |
| **LESSON PLAN** *This template uses the “5E” model to help with planning: Engage, Explore, Explain, Elaborate and Evaluate* |
| **ENGAGE** *Describe how you will start the lesson. How will get students engaged? What prompts will you use to help students access prior knowledge? How will you stimulate their interest and generate questions? This could be an interesting picture, a video with background information, an activity, a game, or even just a series of questions that you ask the students. You can include a pre-assessment here as well – this could be a written “quiz” or just asking questions of the students to gauge what they already know about the subject.*To start, ask students “Why do we care about the past?” Give students a couple minutes to brainstorm (there’s space for them to write their thoughts on the handout), then ask them for some of their answers. This should lead to a discussion that establishes the basic concepts of the lesson: we care about the past for multiple reasons, including to prepare for the future, understand how the present came about, and how things change over time, and additionally that sedimentary rocks are the clues we can use to figure out what happened in the geologic past. This should allow the teacher to lead into the lesson by talking about how sedimentary rocks are the record of environmental change in the past, and so looking at stacked sedimentary rocks can tell us about the past environments and their change over time.  |
| **EXPLORE Lesson Description** *This is the “meat” of the lesson. Give step-by-step instructions of what will be said (prompts) and done. Make sure to indicate what the teaching is doing AND what the students are doing. Include prompts or probing questions to get students thinking on the right track, troubleshooting tips, and what you expect to happen (e.g., students will struggle at first to come up with a model so it might help to show them a few simple examples). Identify the materials that you will be using during each step (there is a place for a detailed list of materials below) and include links for any online videos, maps, etc.*1. Open with quick background on geologic time and the Colorado Plateau. Through the lesson, students will grasp exactly how long geologic time is, and how radically things can change in that time. The Colorado Plateau will be our case study because it’s stable compared to other parts of the world, has thick sedimentary sequences, and, best of all, is right in our backyard! It records 500 million years of time, from the Cambrian Tapeats Sandstone to the Paleocene-Eocene Claron Fm. Discuss why that is useful for talking about geologic history – that it’s more “complete” (records more time) than other areas.
2. If necessary, review some of the skills from previous lessons. Most important to know for this class is how to diagnose depositional environments (and, in this case, continental environments vs marine environments) and the Law of Superposition (that the rocks on the bottom are oldest, while rocks on top are younger). The environments included in the powerpoint are those that students should know to complete the activity.
3. Virtual fieldtrip! The conceit of this activity is that students are going on a fieldtrip from Grand Canyon National Park to Zion National Park, then to Bryce Canyon National Park and finally Arches National Park. At each stop, they are provided with some information, including pictures, a 3D model, and a stratigraphic column. The handout should guide students through observations and prompt them to make interpretations. Perhaps work through the first stop, Grand Canyon National Park, as a class. Allow them to work through at their own pace, checking in as needed.
	1. The most important thing to explain for this activity is the stratigraphic column. These diagrams show the order of different rock formations, like the cross-section from lesson 2. However, these diagrams also contain the names and ages of formations. For this exercise, the “age-range” of rocks will be the name of the time periods involved (for instance, the Grand Canyon would be “Pre-Cambrian to Triassic.”
	2. After visiting each stop, the handout prompts students to organize the information they learned in charts. These charts will help students answer the following question.
	3. The questions at the end of the handout serve two purposes. The first question asks students to summarize the information they have gathered and the interpretations they’ve made into a geologic history of the Colorado Plateau. The second and third question are open ended and should serve to prompt discussion about the implications of this lesson.
4. After everyone has “returned” from their fieldtrip, review the geologic histories students created and discuss their answers to the final questions.
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| **EXPLAIN** **Concepts:** *Describe the major concepts that will be covered in this lesson.*The geologic history of Utah is impressive, and showcases the magnitude of environmental change over time right here in our backyard.**Vocabulary:** *List and define key vocabulary words for this lesson.*Stratigraphic column – a diagram used to depict the vertical location of rocks in a certain areaFormation – a named unit of sedimentary rock that is thick and extensive enough to be recognized over large areas  |
| **ELABORATE:** *Here you can talk about applications of the concepts learned in the lessons or options for further exploration. This is where you can talk about some of the ideas you have that would be great to do but won’t fit into the time frame of this lesson. You may want to provide a list of websites, books, or articles to read for further information.* |
| **EVALUATE:** **Formative Assessment:** *Explain how you will assess how things are going throughout the lesson. This is often a quick check-in to see if students are engaged and are grasping the big concepts. Some of the ways to do this include holding a discussion, doing a think-pair-share activity, or asking students to write down 1 thing that is confusing to them.*During the activity, check in with students to make sure they understand, and if they have any questions. **Summative Assessment:** *Explain how you will assess if students met the learning outcomes. This is often a quiz, homework assignment, project, report, or even just a drawing.*At the end of the activity, review their geologic histories as a class to check understanding. |
| **Notes for Instructors:** *This can be anything from where to find more information, to troubleshooting activity problems, to where to find certain supplies.***As with previous lessons, if you have access to rock samples that can be used here, it would be very useful to include them.** |

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| **Materials Required for This Lesson/Activity** |
| *Insert any diagrams, handouts, pictures, or other materials that aren’t available online HERE.**Include any hyperlinks to online videos, maps and other resources in the “Explore” part of the lesson.**List any other materials, including quantity, potential supplier and price if it is significant.* |