Sample Science Learning Plan

Big Idea/Topic

Water in Earth’s Processes

Standards Alignment

S6E5. Obtain, evaluate, and communicate information to show how Earth’s surface is formed.
   d. Ask questions to identify types of weathering, agents of erosion and transportation, and environments of deposition. (Clarification statement: Environments of deposition include deltas, barrier islands, beaches, marshes, and rivers.)
   e. Develop a model to demonstrate how natural processes (weathering, erosion, and deposition) and human activity change rocks and the surface of the Earth.

Other content areas:

ELAGSE6RI4: Determine the meaning of words and phrases as they are used in a text, including figurative, connotative, and technical meanings.

ELAGSE6RI7: Integrate information presented in different media or formats (e.g., visually, quantitatively) as well as in words to develop a coherent understanding of a topic or issue.

ELAGSE6W2: Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content.

Instructional Design

In this lesson students will obtain, evaluate, and communicate information about weathering and erosion. We will be following The 5E Model (Engage, Explore, Explain, Elaborate, Evaluate) for this lesson plan. A major aspect of The 5E Model is that students are allowed to develop their own understanding of a phenomenon through engagement and exploration before terms are presented. This allows students more opportunities to “discover” the concepts on their own to reach a deeper understanding and connection to the content.

In addition, our Georgia Standards of Excellence in Science have three dimensions, the disciplinary core ideas, science and engineering practices (SEPs), and crosscutting concepts (CCCs). The focus SEPs for this lesson are “Asking Questions and Defining Problems” and “Developing and Using Models.” More information about each SEP and CCC can be found in the following documents: Science and Engineering Practices for GSE Science and Crosscutting Concepts for GSE Science. To support students with using the SEPs, consider using graphic organizers for Asking Questions and Developing and Using Models. The organizers are found on thewonderofscience.com and can accessed there and edited.

Phenomenon: Look at the “Images of Landforms Off the Coast of Georgia” provided in the attached sheets. Do you recognize any of these land features? Can you name any of them without using the photo credits? They are all located off the Atlantic coast of Georgia. How and why do you think they formed? How
are they alike and how are they different? As students go through this process, have them focus on the “Asking Questions and Defining Problems” skills using the graphic organizer.

**Engage:** After viewing the images, fill in the KWL chart with your observations and questions about the landforms. Be sure to include how they are alike and different. Now you are ready for the “Barrier Island Location Challenge”. Try to arrange the islands in the correct location off the coast from north to south. Check your answers against the map provided. How well did you do? As you go along do not forget to fill in your KWL chart with any new information you are learning, and any new questions that you have.

**Plugged:** If you have access to the internet, go to Google Earth and click on “Launch Earth” and zoom in on the coast of Georgia until you can see the islands in detail. Notice the shape of each island and generate some new questions in your KWL chart. How do you think these islands formed?

Additional Engagement Videos from Georgia Public Broadcasting (GPB):

- Georgia Under the Ground
- Skidaway Island State Park

**Unplugged:** Consider providing students printed maps or diagrams if they do not have access to use google Earth.

**Explore:**

In this section, we will be exploring how sandy beaches are affected by the action of waves through a hands-on modeling simulation. Students will observe the effects of water erosion with different sizes of waves and different angles from which the water strikes the beaches. Please see the attached sheets for instructions and materials.

**Plugged:** The teacher should consider videoing the experiment to share with students that do not have the materials at home to complete the activity. As an alternative, teachers may want to share a pre-made video.

**Unplugged:** The teacher should take pictures of the experiment to share with students that do not have the materials at home to complete the activity.

**Explain:**

In this section, we will introduce the concepts and the terms used to develop explanations for the phenomenon we have just observed. This is important to the 5E model that explanation follows experience. We will explain the different types of weathering and erosion processes that formed the barrier islands using the attached note sheet. An alternative to filling in the note sheet is to print off the key and cut it apart and let the student try to figure out where each definition goes, then they can paste or fill in the information once they have it checked.

For a formative assessment, have the students complete the Venn Diagram to compare and contrast the three main types of weathering.

**Plugged:** For more background information on landforms of the Georgia coast, please visit the following links.

- Geology of the Georgia Coast
- Lower Coastal Plain and Coastal Island
- Longshore Current Animation
Georgia’s Barrier Islands

**Unplugged:** For students without internet access, the instructor can print out the information provided from the website links listed under the “plugged” section.

**Elaborate:**

In this part of the lesson, it is important to provide opportunities for students to apply what they have learned so far to new situations to gain a deeper understanding of the content. Students will extend their knowledge by considering the impact of human activity on the Earth’s surface.

The focus SEP of this standard is “developing and using models”. See the attached sheet for an explanation of this practice and the skills students should be able to perform Tybee Island Project. A graphic organizer is also included to help students develop their model for the in the “Evaluate” section of this lesson.

**Plugged:** For more information about beach erosion on Tybee Island, please go to the following link: Georgia DNR: Tybee Island

**Unplugged:** For students without internet access, the instructor can print out the information provided from the website links listed under the “plugged” section.

**Evaluate:**

As evidence of understanding, students will be evaluated on their Tybee Island Project according to the guidelines provided on the project description sheet.

### Evidence of Student Success

Student mastery is assessed throughout this unit using formative and summative components. Student discussion, explanations and products should reflect the understanding indicated in the Evaluate section above. Each activity in the segment functions as an assessment opportunity as well to plan targeted support or provide extension items. Formative options using the self-evaluation checklist and the activities at various points during the segment.

### Student Learning Supports

The vision for science education in the state of Georgia is as follows: All Students, over multiple years of school, actively engage in science and engineering practices and apply crosscutting concepts to deepen their understanding of the core ideas in these fields.

The learning experiences provided for students should engage them with fundamental questions about the world and with how scientists have investigated and found answers to those questions.

This lesson includes the disciplinary core ideas, science and engineering practices and crosscutting concepts to actively engage students in exploring science concepts with real world topics. As part of the vision, we must support the inclusion of all students in science learning. Some general ideas to consider when designing things to support students that struggle are as follows:

- Be sure that students can access the information that you they are learning. Make sure that you can answer the following questions:
- Do students have what they need to get the information? This is about them having the book or internet access to get to the information.
- Once students obtain the information, are students able to determine what information is important? This is about the students having materials on the appropriate grade level and that is in a format that students can understand.
- Is the material presented in multiple ways that allows all students to interact with information in a way that works for them? Such as video, audio, and articles.
- Consider read aloud as a potential option for students that have reading deficits as an option to assist students in accessing the material. This could be done using video, read aloud or via phone.

- Students may need ideas about where to find information. Providing students with information about what a reliable source is and even where to find reliable sources may be beneficial for students.
- Some students may find it difficult to complete the entire lesson workload. Some students may benefit from a reduced workload (note: this should be used only when absolutely necessary). Be sure that the information that is removed will not negatively impact the student’s understanding of the disciplinary core idea.
- Consider how students show their knowledge. Students need multiple ways and opportunities to show their knowledge. Things to consider:
  - Recording video or audio
  - Drawing
  - Writing
  - Typed
  - Verbal

- Provide students with a way to ask questions in a forum that does not cause anxiety. Frequently students do not want to ask questions in front of their peers because they are afraid of what their peers may think of them. So, be sure to provide students a way to ask questions that is private or anonymous.
- Consider materials that students need to complete the assignments.
  - Do students have needed materials?
  - What are some alternative materials that students may have available to them?
- Have a clear and consistent set of guidelines for providing consistent feedback to all students.
- Utilize graphic organizers such as those from the Wonderofscience.com
- Use high leverage and evidence-based practices to reach all students.

Some ideas for supporting this lesson specifically would be to make sure to consider the following:

- Students may need the questions for the phenomena provided to them in writing or in a video so that they may refer back to them.
- Students my need to be reminded that they can record in the KWL chart as they work.
- It, also, might be advisable to remind students that they can record information in whatever format works for them. These formats could include writing, drawing, text-to-speech or verbally talking it through with a partner.
- The teacher should consider providing directions for using Google Earth that students can refer to when using. These directions could be in the format of written directions or video directions.
• The teacher should consider providing information to parents that they can use to help their students complete the assignment.
• The teacher should consider videoing the experiment or taking pictures of the experiment to share with students that do not have the materials at home to complete the activity.
• The teacher should consider providing students with an opportunity to discuss their ideas and provide students with the format and guidelines to do have those discussions.
• The teacher should consider providing students with articles and videos that they can use for additional information.
• The teacher should consider providing students with a rubric for the Tybee Island project. That way students can evaluate their own work.

**Engaging Families**

Additional resources to support this segment can be found at GPB: [Georgia Home Classroom](#)
Graphic Organizer for SEP Asking Questions

1. Describe the phenomenon

2. Brainstorm questions

3. Crosscutting concept

4. Additional questions

5. Testable?
Images of Landforms Off the Coast of Georgia

Photo Credit: Tim Kiser; Creative Commons Attribution-Share Alike 4.0; Image Source


KWL Chart

Topic: ____________________________________________________________

<table>
<thead>
<tr>
<th>What I think I know ...</th>
<th>What I wonder or want to know ...</th>
<th>What I have learned ...</th>
</tr>
</thead>
<tbody>
<tr>
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</tbody>
</table>
Barrier Island Location Challenge

Listed below in the table are the names of barrier islands off the coast of Georgia. Print this sheet and cut out each island name individually. Now you are ready for the challenge! Arrange the names of the islands in their correct location off the coast of Georgia from north to south. Then check your answers against the map to see how well you did. Show what you know! Good luck!

<table>
<thead>
<tr>
<th>Name of Island</th>
<th>Name of Island</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cumberland</td>
<td>St. Catherine’s</td>
</tr>
<tr>
<td>Blackbeard</td>
<td>St. Simons</td>
</tr>
<tr>
<td>Jekyll</td>
<td>Sapelo</td>
</tr>
<tr>
<td>Little Cumberland</td>
<td>Sea</td>
</tr>
<tr>
<td>Little St. Simons</td>
<td>Tybee</td>
</tr>
<tr>
<td>Little Tybee</td>
<td>Wassaw</td>
</tr>
<tr>
<td>Ossabaw</td>
<td>Wolf</td>
</tr>
</tbody>
</table>
Source of image: Georgia Department of Natural Resources, Environmental Protection Division, Georgia Geologic Survey, B-98.pdf (georgia.gov)
Hands-on Simulation of Wave Action on Sandy Beaches

Materials:

- Play sand
- Long rectangle aluminum disposable pan with sides at least 2 inches high and a length of at least 12 inches
- Water
- Plastic sheet to protect the table (optional)
- Wooden popsicle craft sticks of different sizes (width and length)
- Any other objects of different sizes to create waves
- Safety goggles and apron (optional) to protect clothes
- Observation sheet (provided)

Procedures:

1. Once you have secured your materials, find a suitable place outdoors or on a porch to set up the lab. You will need a flat table that can get dirty or cover it with a plastic sheet or trash bag. Put on your safety goggles to protect your eyes from any sand.
2. Place the play sand in the aluminum pan along one of the long edges until it covers a third of the pan (see Figure A in diagram).
3. Carefully add the water to the pan until it rises almost to the top of the sand, but you still want to have some of the sand exposed and not covered with water.
4. Wait until the water calms down as much as possible and is not moving before you start each of the wave actions. Now you are going to perform some simulated wave actions to your “beach” using the different sized wooden craft sticks or other similar objects (the red object in Figure A).
5. For the first wave action, hold the craft stick parallel to the “beach” and slowly push the water toward the beach so that the “waves” hit the beach at a right angle (see direction of arrows in Fig. A). Record any observations on your sheet about how the sand grains are moving. Try using a larger object to create the waves at the same angle and record any observations.
6. Wait until the water settles down again and this time you are going to create waves that will hit the beach at an angle. Place the craft stick in the water this time so that it is perpendicular to the beach at one of the short ends of the pan (the red object in Figure B). Slowly push the water with the stick going straight towards the other short end of the pan (in the direction of the long arrow). The “waves” should now be hitting the beach at an angle.
7. Record any observations on your sheet about how the sand grains are moving. Repeat the procedure a few times but remember to allow the water to settle down between each attempt. Try creating larger waves during these repeated attempts and record any differences.
8. Reflect on the lab and answer the following questions.
9. Do not dismantle your lab yet, you might use it again later to create a model for the Tybee Island Project.
Figure A. Direction of waves that hit the beach at a right angle.

Figure B. Direction of waves that hit the beach at other angles.
Wave Action on Sandy Beaches Observation Sheet

In the table below, draw a picture of what you observed before and after the waves hit the beach at a right angle.

<table>
<thead>
<tr>
<th>Wave Size</th>
<th>Before Waves</th>
<th>After Waves</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small Waves</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Large Waves</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

In the table below, draw a picture of what you observed before and after the waves hit the beach at other angles.

<table>
<thead>
<tr>
<th>Wave Size</th>
<th>Before Waves</th>
<th>After Waves</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small Waves</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Large Waves</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Questions for Wave Action on Sandy Beaches Observations

1. Describe the differences in sand movement when the waves hit the beach at a right angle as compared to other angles.

2. How do you think this relates to the shapes of the barrier islands off the Georgia coast?

3. How did the barrier islands form there in the first place?

4. Don’t forget to continue to re-visit your KWL chart to fill in any new information, observations, and questions you may have at this point.
Types of Weathering and Erosion Note sheet

<table>
<thead>
<tr>
<th>Physical Weathering</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Examples</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chemical Weathering</td>
<td></td>
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<tr>
<td>Examples</td>
<td></td>
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</tr>
<tr>
<td>Biological Weathering</td>
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<tr>
<td>Examples</td>
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<td></td>
</tr>
</tbody>
</table>
# KEY to Types of Weathering and Erosion Note sheet

<table>
<thead>
<tr>
<th>Physical Weathering</th>
<th>Water</th>
<th>Air</th>
<th>Wind</th>
</tr>
</thead>
</table>
| (Have students add a drawing here to represent physical weathering) | • Seeps inside cracks, then freezes to wedge rocks apart  
• Rivers tumble rocks  
• Rain, snow, ice, and sleet | • Temperature changes cause rocks to expand and contract, which weakens and cracks them | • Sand and smaller rocks get blown against larger rocks, chipping and smoothing them away |

| Examples | Sidewalk cracks, potholes, smooth river rocks | Cracks on surfaces of rocks | Smooth rocks in deserts, pits in stone buildings |

<table>
<thead>
<tr>
<th>Chemical Weathering</th>
<th>Water</th>
<th>Acid Rain</th>
<th>Air</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Have students add a drawing here to represent chemical weathering)</td>
<td>• Enters cracks and pores of rocks, chemicals in the water react with minerals in rock and dissolve or change them</td>
<td>• Rain that has the pollutants nitrogen and sulfur, which combine to make a weak acid that dissolves minerals in rock</td>
<td>• Has oxygen that reacts with minerals such as iron, aluminum, silicon, and copper</td>
</tr>
</tbody>
</table>

| Examples | Caves, statues, and buildings dissolving | Stone statues and concrete dissolving features | Iron rusting, copper turning green |

<table>
<thead>
<tr>
<th>Biological Weathering</th>
<th>Plants</th>
<th>Animals</th>
<th>Humans</th>
</tr>
</thead>
</table>
| (Have students add a drawing here to represent biological weathering) | • Tree roots and small plants grow into rocks and break them apart or enlarge cracks  
• Lichens grow on rocks and make an acid that dissolves them | • Burrowing animals dig and scrape on and around rocks | • Change rock by excavating, digging, mining, and construction |

| Examples | Weeds in sidewalks, tree roots cracking sidewalks | Animal homes or burrows in and around rock | Rock steps worn down from walking, mines |
Venn Diagram to Compare & Contrast Types of Weathering

As a check for understanding, have the student fill in the following diagram to compare and contrast the three types of weathering.
Graphic Organizer for SEP Developing and Using Models

1. Define the Boundary
2. Draw and label the Components
3. Identity relationships between the Components
4. System
5. Describe the Phenomenon
6. Explain Use the model to...

Adapted from: Georgia Standards Avery & Avery Resource

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1.15.2021 • Page 18 of 19
Tybee Island Project

Georgia’s northern-most barrier island, Tybee, has been suffering from major sand erosion from its beaches for decades. They have tried many solutions to date without much success. Most recently $13.8 million dollars has been spent to renourish their beaches after damage suffered from hurricanes Matthew and Irma in 2016 and 2017. Develop a model that would explain why they are having this sand erosion problem and what you would propose as a solution to prevent it.

As you have learned about weathering and erosion through this lesson, now you will be able to put that expertise to use to help solve a big problem on Tybee Island. You will develop a model that explains why Tybee Island’s beaches are eroding away, and what solution you propose to stop it. Your model can take the form of a physical simulation like the Sandy Beaches lab, a drawing or diagram, a computer animation, etc.

The model must explain and address the following issues using the key vocabulary terms provided:

- Three main types of weathering
- Agents of erosion and transportation
- Environments of deposition – barrier islands, beaches, marshes
- Demonstrates how natural processes (weathering, erosion, deposition) form and change the barrier islands
- Demonstrates how human activity (dredging, construction, excavating, digging) has affected sand erosion problems on the island

The model must also include the correct use of the following key vocabulary terms:

- Accretion
- Barrier Island
- Beach
- Deposition
- Erosion
- Landforms
- Longshore currents
- Marsh
- Sand
- Waves
- Weathering