

5Es Instructional Model Plan:	Patterns of Stream Erosion and Deposition
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NGSS Performance Expectation Cluster:	MS-ESSS-2-2
Grade Level(s):	Middle School (6-8)
Time:	4-5 days, 30-45 minutes each day

5Es – Conceptual Flow	
	Engage: <i>What do students know about streams and erosion?</i> The teacher finds out what students know about stream systems by asking them to connect prior experiences to what is happening in the stream table .
	Explore: <i>Students make observations from a stream table model</i> Students will explore the processes associated with stream systems by collecting and analyzing data from an actual small-scale erosion-depositional system (stream table) in order to identify patterns in the relationship between water movement, velocity, and erosion or deposition .
	Explain: <i>Students develop explanations for characteristics of a stream system</i> Students use patterns in the relationships between water movement and velocity and stream erosion or deposition to predict and explain characteristics of a stream's anatomy at different points in a stream system and the stream's impact on humans and the natural world .
	Elaborate: <i>Students learn about factors that affect the transport and deposition of particles in a stream</i> Students will conduct an investigation to develop a deeper understanding of the factors that affect patterns of particle deposition in a stream .
	Evaluate: <i>Relating the phenomenon to the performance task</i> Students will construct an explanation that explains how or why the flooding in a local community came to be and the impact this has on the local community and natural world.

MS-ESS2-2. Construct an explanation based on evidence for how geoscience processes have changed Earth's surfaces at varying time and spatial scales.		
Science and Engineering Practices Constructing Explanations and Designing Solutions - Construct a scientific explanation based on valid and reliable evidence obtained from sources including students' own experiments Developing and Using Models - Develop and/or use a model to generate data to	Disciplinary Core Ideas ESS2.C: The Role of Water in Earth's Surface Processes Water's movements – both on the land and underground – cause weathering and erosion, which change the land's surface features and create underground formations	Crosscutting Concepts Cause and Effect - Relationships can be classified as causal or correlational, and correlation does not necessarily imply causation. Scale, Proportion, and Quantity - Time, space, and energy phenomena can be observed at various scaled

test ideas about phenomena in natural or designed systems, including those representing inputs and outputs, and those at unobservable scales		using models to study systems that are too large or too small
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	Engage: <i>What do students know about streams and erosion?</i>	
Materials:	Photos or news story, post its, colored pencils, pencils	
Planning for Modes of Engagement:	Altruism Inventing Conservationism Investigating Designing Tinkering	
Instructional Sequence:	- Show students a photo or news story about weather-related flooding, erosion, and wash-outs. <i>Work to make this phenomenon as relevant to your students' community as possible. Suggestions for general phenomena can be found at the end of the lesson plan.</i> - Have students make observations and respond to the following prompts (in writing or graphically): - What do you notice? - What do you wonder? - Does this remind you of anything you've seen or experienced before? - What do you think this means for this environment? - What do you think this might mean for this community? - Have students record their responses on post-it notes and share their responses with a partner. Then have several partnerships share out their responses with the rest of the class. - Reflect on student ideas and plan forward based on student understandings, incomplete ideas, and prior conceptions.	

	Explore: <i>Students make observations from a stream table model</i>	
Materials:	Stream table, colored pencils, pencils, science notebooks or paper,	
Planning for Modes of Engagement:	Altruism Inventing Conservationism Investigating Designing Tinkering	
Instructional Sequence:	Launch students into investigating stream erosion and deposition patterns by having them observe how water moves in a stream using a stream table.	

	<i>If you cannot access a stream table for your classroom, consider making smaller versions or consider using videos (see links at the end of the lesson plan for additional resources)</i> Help students to notice the stream's meander, erosion, and deposition. - As students engage with the stream table, press students to share their observations. - Have students draw their observations and create initial models depicting what is occurring in the stream table and why.
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	Explain: <i>Students develop explanations for characteristics of a stream system</i>		
Materials:	Stream table, Anatomy of a Stream signposts		
Planning for Modes of Engagement:	Altruism Inventing Conservationism Investigating Designing Tinkering		
Instructional Sequence:	- Now that students have made observations and the stream has been flowing long enough for meanders to form, have students work to identify the anatomy of the stream. - As youth take turns reading their signposts, have them discuss the explanation on the signpost and place the signpost in the stream table where they think that word is being referenced. - Guide the discussion to encourage all students to share their observations and build on peers' ideas. Clarify any misconceptions as needed. - Using information gathered from previous observations, begin a discussion about ways in which stream flow, erosion, and deposition might affect or impact the natural world. - Who or what might live in or near a stream like this? - What did you notice about the erosion? Where did those materials go? How would this affect what lives here? - Place a small house (or an object representing a house) on the bank of the stream, precariously close to the water. - Using the house, its placement, and information gathered from previous observations, shift the conversation to a discussion about both the ways in which erosion and deposition might affect people and how people might affect the stream system. - What did you notice about the erosion? What does this mean for the people who live in this house or live in this community? - How could the people in this community (or this house) have contributed to this erosion and deposition?		

	Elaborate: <i>Students learn about factors that affect the transport and deposition of particles in a stream</i>
Materials:	Stream table, small rocks, gravel, twigs, straw, mulch or pine needles, strips of cheesecloth
Planning for Modes of Engagement:	▣ Altruism ▣ Conservationism ▣ Designing ▣ Inventing ▣ Investigating ▣ Tinkering
Instructional Sequence:	1. Have students return to the stream table and review the anatomy of the stream and the erosion and deposition they observe. 2. In small groups, youth will discuss ways to stop erosion, minimize deposition, and/or control the stream direction and flow. 3. Launch students into brainstorming and designing ways to stop erosion, minimize deposition, and/or control the stream direction and flow using provided materials (small rocks, gravel, twigs, straw, mulch, pine needles, and strips of cheesecloth). • Ask students to sketch their ideas and how they think their idea will impact the stream system. • Encourage students to think about why they are designing these solutions in this way. Who or what are they hoping to affect? How will their idea impact that community or place? 4. Have students take their collective ideas to the stream table. Here, students will use the materials provided to investigate how to redirect the water, control erosion, and/or minimize deposition. • Allow groups to test multiple ideas and plans. • Support students in noticing the benefits and drawbacks of each trial by looking for new erosion, deposition, and/or stream flow. 5. When students have created, built, and tested multiple ideas provide space and time for students and groups to share their solutions with the entire class.

	Evaluate: <i>Relating the phenomenon to the performance task</i>
Materials:	Original photo or news story, paper, pencils, colored pencils
Planning for Modes of Engagement:	▣ Altruism ▣ Conservationism ▣ Designing ▣ Inventing ▣ Investigating ▣ Tinkering
Assessment Task:	• Present students with the photo or news story that served as the phenomenon in the Engage portion of the lesson • Assessment Task: <i>Drawing from what you have observed and investigated, create a model that shows your thinking about how and why the incident in that [photo/news story] happened. Also work to include who or what might be affected by this.</i>

	Students should have access to their observations, models, sketches, brainstorming materials, the Anatomy of a Stream signposts, and all instructional materials used throughout this lesson.
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	Resources
	- Make you own stream table: https://www.sciencefriday.com/educational-resources/stream-table/ - Erosion phenomenon (photo credit: www.NGSSphenomena.org)  - Erosion phenomenon (photo credit: Creative Commons) 