Erosion Experiment

Erosion in the Arroyo Unit, Lesson 2

Lesson Summary: Students will conduct an experiment that helps them understand the process of erosion and that erosion primarily depends on the energy of moving water.

Suggested Timing: 1 hour

New Mexico State Standards

Performance Expectation(s):

MS-ESS2-4: Develop a model to describe the cycling of water through Earth's systems driven by energy from the sun and the force of gravity.

MS-PS3-5: Construct, use, and present arguments to support the claim that when the kinetic energy of an object changes, energy is transferred to or from the object.

Science & Engineering Practices:	Disciplinary Core Ideas:	Crosscutting Concepts:
Developing and Using Models: Modeling in 6–8 builds on K–5 experiences and progresses to developing, using, and revising models to describe, test, and predict more abstract phenomena and design systems. Develop a model to describe unobservable mechanisms. Engaging in Argument from Evidence: Engaging in argument from evidence in 6–8 builds on K–5 experiences and progresses to constructing a convincing argument that supports or refutes claims for either explanations or solutions about the natural and designed worlds. Construct, use, and present oral and written arguments supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon.	ESS2.C: The Roles 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. PS3.B: Conservation of Energy and Energy Transfer: When the motion energy of an object changes, there is inevitably some other change in energy at the same time.	Energy and Matter: Within a natural or designed system, the transfer of energy drives the motion and/or cycling of matter.

Evidence Statements:

- <u>MS-ESS2-4 Evidence Statements</u>
- <u>MS-PS3-5 Evidence Statements</u>

ELA CCSS Connections:

- RST.6-8.1: Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions. (MS-PS3-5)
- WHST.6-8.1: Write arguments focused on discipline content. (MS-PS3-5)

Math CCSS Connections:

• MP.2 Reason abstractly and quantitatively. (MS-PS3-5)

- 6.RP.A.1: Understand the concept of ratio and use ratio language to describe a ratio relationship between two quantities. (MS-PS3-5)
- 7.RP.A.2: Recognize and represent proportional relationships between quantities. (MS-PS3-5)
- 8.F.A.3: Interpret the equation y = mx + b as defining a linear function, whose graph is a straight line; give examples of functions that are not linear. (MS-PS3-5)

Content Objectives and Daily Learning Targets	 Objectives: I understand the process of erosion and deposition. I can explain how water and gravity cause erosion. I can describe how the kinetic energy of water impacts the type of erosion that occurs. I can explain how solar energy and gravity impact water-driven erosion.
Focus Question	How do erosion and deposition change the geological features around us?
Language Objectives	 Students can use scientific vocabulary to describe what they notice. Students can use accurate language to record results of an experiment.
Vocabulary	 Erosion - process in which earth materials are worn away and transported by natural forces such as wind or water. Deposition - process of laying material down or depositing. Gravity - the force that attracts a body toward the center of the earth, or toward any other physical body having mass. Geological process - the natural forces that shape the physical planet. Kinetic energy - the energy an object has because of its motion. Potential energy - the stored energy an object has because of its position or state.
Materials	 Cardboard (long boxes, at least 2-3 feet long and a foot wide Trash bags or plastic large enough to encase the cardboard Sediment with different sizes/textures (rocks, pebbles, gravel, sand, garden soil) Scissors Watering cans with the shower heads (to slow and spread out water flow) Protractors (to measure angle of tilt) Buckets or similar to catch the water and sediment
Preparation before class	Collect materials or assign this to the students
Assessments (Formative/ Summative), Rubrics, Success criteria	 Lab report Success criteria: Students understand the relationship between water and erosion Students understand the relationship between slope and flow rate of water



EL Supports	 Provide key vocabulary in the student's first language.
Culturally Relevant Strategies	 Students work together to conduct the experiment. Students investigate the local environment, which is an important part of the local culture.
Special Education Modifications	• Students are able to express their thinking in multiple ways, allowing them to build on their strengths.

Lesson Plan Details

ENGAGE (~5 min):	 Have students watch this short video showing erosion caused by water: <u>Erosion Video</u> Ask students to think-pair-share using these prompts: Where does the water come from? How do you think the speed of the water impacts erosion?
EXPLORE (~15 min):	 Hand out materials Have students construct their own arroyo bottom model. Start by creating a cardboard tray that is open at one of the long ends. Cover the tray with the plastic bag to prevent the cardboard from getting wet. Have students arrange the soil, sand, gravel, rocks and pebbles in the tray to resemble the bottom of the arroyo. Ask them to explore how water might flow through the arroyo. Have them take notes on their findings.
EXPLAIN (~10 min):	 Ask students to share what they have noticed with the class and what they still wonder. Ask them how this relates to the arroyo they investigated. Share that you are going to now test how the kinetic energy of water impacts erosion. Review kinetic energy and how this relates to water.



	 Review how to use a protractor to measure angle of slope. Ensure students understand that the steeper the slope, the greater the potential (and then kinetic) energy the water will have.
ELABORATE (~15 min):	 Have students choose 3 angles to test (suggested: 5 degrees, 15 degrees, 25 degrees) Discuss how to minimize variables: Same amount of water should be used each time Poured at the same height and at the same rate All materials should be replaced to the same position. Students should record what they observe.
EVALUATE (~15 min):	 Have students work with their lab groups to answer the reflection questions. As a whole class create a diagram explaining how erosion is connected to solar energy and gravity. Have them add this diagram into their notes. Example diagram:
	Note: Keep the models to use to conduct erosion prevention tests.



Additional Sources:

- <u>5 Es of Science Instruction</u>
 <u>5E Model of Instruction</u>
 <u>ISEC model of lesson sequence</u>

