Sand Sleuths:

Solving the Mysteries of Sand Erosion

Submitted by: Alicia Miller, Science
Lewiston Elementary School, Evans, GA

Target Grade: 3rd-4th Grade
Time Required: 90 minutes
Standards:
NGSS

- **4-ESS2-1**. Make observations and/or measurements to provide evidence of the effects of weathering or the rate of erosion by water, ice, wind, or vegetation.

Common Core ELA

- **CCSS.ELA-LITERACY.SL.3.1** Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 3 topics and texts, building on others' ideas and expressing their own clearly.
- **CCSS.ELA-LITERACY.SL.3.4** Report on a topic or text, tell a story, or recount an experience with appropriate facts and relevant, descriptive details, speaking clearly at an understandable pace.
- **CCSS.ELA-LITERACY.SL.4.1** Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 4 topics and texts, building on others' ideas and expressing their own clearly.
- **CCSS.ELA-LITERACY.SL.4.4** Report on a topic or text, tell a story, or recount an experience in an organized manner, using appropriate facts and relevant, descriptive details to support main ideas or themes; speak clearly at an understandable pace.

Lesson Objectives:

Students will:

- model sand erosion with wind and water.
- make observations and take journal notes to record findings.
- engage in discussions with small groups of peers.

Extension Objectives:

Students will:

- explore how the variable of grain size affects erosion.
- explore the use of different materials for a breakwater.

Central Focus:

How does sand move? What affect does wind and water have on sand? How might a breakwater play a part in preventing erosion? Students will use observation skills as they investigate the movement of sand and discover how wind and water cause erosion and how a breakwater can help prevent erosion.

Key words: grain, texture, weathering, erosion, breakwater

Background Information:

Sand can be composed of different rocks and minerals. It forms when large boulders are weathered and eroded. The fine grains that come away as the rock breaks down, creating sand.

Erosion is the process of wearing down the surface of the Earth. Most erosion occurs due to water, wind, or ice.

Waves, currents, tides, winds, storms, and changes in sea level can all have a great impact on islands. When waves and currents remove sand from the shore, the beach becomes narrower and lower in elevation. This can cause a serious problem when there are series of storms which carry the sand away and leave coastal property threatened.

A breakwater is a barrier of rocks that can be built above or below the water's surface. The structure causes the waves to break and dissipate before hitting the shore. A submerged breakwater is built below the water to protect the coast from erosion caused by waves.

Materials

- Picture Book –*The Disappearing Island* by Corinne Demas or any other book with a story about erosion.
- Smart Board
- ELMO - Document Camera - To display book, directions, or data charts
- LEGO Bricks, Lincoln Logs, Keva Planks, or other building materials that will hold up in water.
- Sand - You will need 1-2 pounds, one small bucket full, for each group. The sand can be reused for subsequent trials.
    - Optional – You may want to have students extend the lesson using sands with a variety of grain sizes.
- Large Spoon or small sand shovel – 1 per group
- Drinking Straw – 1 per student
- Erosion Tray -1 per group – Any plastic trays with at least a 1-inch lip should work. *If conducting this investigation indoors, you may want to lay the erosion tray in a larger

plastic tub to catch any water spills. More trays may be used, depending on how many types of sand samples you intend for students to try.

- Pitcher or Water Bottle -1 per group
- Plastic or paper cups – 9 to 12 oz- 1 per group
- Water
- Directions page – 1 per group
- Observation Charts – 1 of each per student

Instruction

Advance Preparation

- Have heterogeneous group assignments ready.
- Print directions – 1 copy per group.
- Print observation charts - 1 of each per student.
- Have water available.
- Each group should have: a tray, a straw for each student, a permanent marker to write their name on their straw, a water bottle, a cup, a copy of the directions, and a data chart for each student in the group.
- Place building materials where all groups can easily access them.

Lesson Introduction 10 – 30 min.

- Read aloud The Disappearing Island, by Corinne Demas (This part of the lesson time depends on whether this is the first reading and whether any text discussion will take place during this reading.)

Whole Group 5 minutes

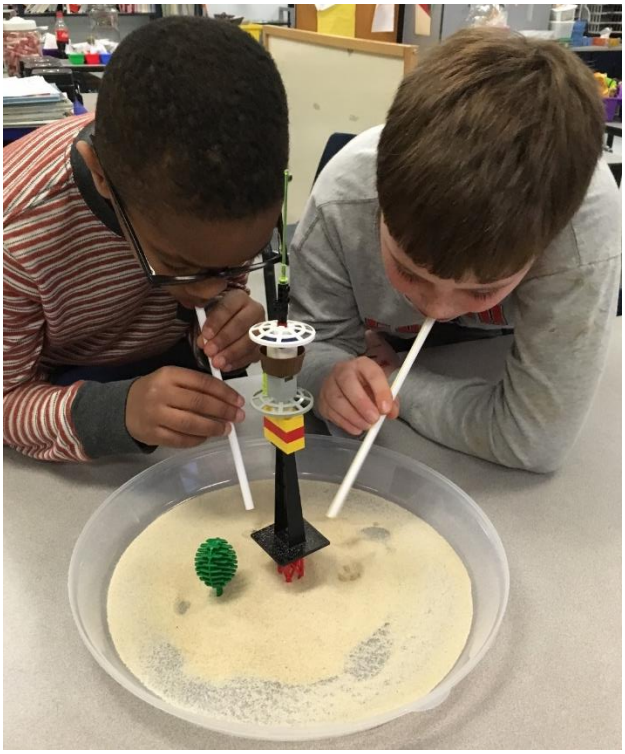
- Go over directions for the lighthouse build and break into groups of 4 – 5 students. Students are to build a lighthouse that will be standing in the sand.

Small Group 15 minutes

- Students work together to build the lighthouse that will be used on their island.

Whole Group 10 minutes

- Allow students to share completed lighthouses with the whole group.
- Go over directions and hand out materials, for creating an island with the sand, before sending students back to small groups.
    1. Shovel a pile of sand in the middle of the water tray to create an island.
    2. Next, place the lighthouse somewhere on the island.
    3. Use the observation chart to complete the tasks in the order listed. Write observations after each step.



Small Group 15 – 20 minutes (to complete steps 1-3 above)

- Remind students to work quickly, otherwise much time could be lost here.

Whole Group 15 minutes

- Allow students to share observations with the whole group, especially if anything unusual happened in their group.
- Show YouTube videos of a breakwater. There are numerous pictures and videos that can be shown, a few links are below:
    - Natural Rocks: https://www.youtube.com/watch?v=RtvG8Fh5NHQ
    - Man-Made Rocks: https://www.youtube.com/watch?v=fbgAomgNMAU
    - https://www.shutterstock.com/video/clip-13104107-breakwater-stone-into-ocean
    - Wooden Breakwater made from tree trunks: https://www.videoblocks.com/video/lonely-girl-barefoot-stands-on-the-sand-loneliness-sadness-dreaming-girl-breakwater-sea-surf-small-waves-tide-sandy-sea-shore-sunny-summer-day-m9dlmt3
- Give the following directions for the breakwater task before sending students back in to small groups.

1. Build a breakwater structure out of LEGO bricks or other materials. Make sure it is large enough to surround at least half of the island.
2. Pile the sand back up in the middle of the water tray.
3. Next set the lighthouse back on top of the sand and place the breakwater on top of the sand, protecting the lighthouse.
4. Finally, use the second observation chart to complete the tasks in the order listed. Write observations after each step.

Small Group 15 minutes

- Students work together to build their breakwater and reassemble their island before completing the tasks on the second observation chart. Remind them to write their observations after each step.

Whole Group 10 minutes

- Students share their findings before writing final paragraph for assessment.

Conclusion

- Students will write a paragraph describing erosion and how a breakwater can reduce erosion.

Differentiation

Approaching Level:

- ELL: Provide on-line pictures of lighthouses to build background and give visual support. Provide a word bank or sentence stems as needed for the observation chart.
- Fine motor difficulties: Use DUPLO blocks or other materials that would be easier to manipulate.

Beyond Level Extension:

- Students can do the activity using different sands with a variety of grain sizes to compare the erosion. They can also create additional breakwaters to increase efficiency.

Assessment

Formative Assessments

- Teacher observation of island setup, erosion trials, and completed Sand Observation Charts.

Summative Assessment

- Students will write a paragraph describing erosion and how a breakwater can reduce erosion.
    - Assessment Differentiation: Students dictate or draw their "wonderings."

Lighthouse Directions

1. Choose a material to create a lighthouse no larger than 10 inches tall and 3 inches wide.

Island Directions

1. Shovel a pile of sand in the middle of the water tray to create an island.
2. Next, place the lighthouse somewhere on the island.
3. Use the observation chart to complete the tasks in the order listed. Write observations after each step.

Breakwater Directions

1. Build a breakwater structure out of LEGO bricks or other materials. Make sure it is large enough to surround at least half of the island.
2. Pile the sand back up in the middle of the water tray.
3. Next set the lighthouse back on top of the sand and place the breakwater on top of the sand, protecting the lighthouse.
4. Finally, use the second observation chart to complete the tasks in the order listed. Write observations after each step.

Disappearing Island Observation Chart Name_____

Cause	Procedure	Observations
Wind 	Gently blow through the straw in the direction of your island.	
Slow Moving Water 	Gently pour water near the island.	
Fast Moving Water 	Quickly pour water near the island.	

Conclusions:_____
_____
_____
_____

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Conclusions:_____
_____
_____
_____

Breakwater Observation Chart Name_____

Cause	Procedure	Observations
Wind 	Gently blow through the straw in the direction of your breakwater.	
Slow Moving Water 	Gently pour water near the breakwater.	
Fast Moving Water 	Quickly pour water near the breakwater.	
Conclusions:_____ _____ _____ _____		

Breakwater Observation Chart Name_____

Cause	Procedure	Observations
Wind 	Gently blow through the straw in the direction of your breakwater.	
Slow Moving Water 	Gently pour water near the breakwater.	
Fast Moving Water 	Quickly pour water near the breakwater.	
Conclusions:_____ _____ _____ _____		