Save the Sand Towers Part 2

Main Concept addressed in lesson: This lesson will teach students how erosion can be slowed down by reinforcers.

Relationship to Standards:
NGSS – Matter and its Interactions – 2. Analyze data obtained from testing different materials to determine which minerals have the properties that are best suited for an intended purpose.
NGSS – Design in Technology and Engineering Education – 5. Illustrate that there are different solutions to a design and that none are perfect
This lesson allows students to understand how materials and minerals are used purposefully. This lesson also helps students understand that scientific processes are never perfect but there are a variety of ways to work through a design.

Key Science Topic(s): Students will need to have an understanding about erosion, the reinforcers we have used and talked about throughout the unit (retaining wall, trees, sandbags, and grass), and what reinforcers have worked and not worked in the past experiments

Key Process Skills Used or Learned During Lesson: Students will use problem solving skills as well as critical thinking skills to learn the concepts in this lesson. Students will be developing a stronger sense of cause and effect skills during this lesson

Student Background including Potential Misconceptions: Earlier in this unit, students have had the opportunity to see how each individual reinforcer (retaining wall, trees, sandbags, and grass) have resisted the flow of water (modeling a rainstorm) to see which were effective or ineffective. Students may have some of these reinforcers at their own home, which may lead to misconceptions around a retaining wall. For example, some students might see a retaining wall and assume it is to put a wall around the garden, and not know it's intended purpose

Grade Level(s) appropriate for this lesson: 2

Time Required (including Teacher Preparation): This lesson should take about 75 minutes in total. It will take about 30 minutes to prepare for the lesson and 45 for the actual lesson to take place. Teacher preparation includes setting up 2 sand castles. I will also need to set up a stream table and place toothpicks (represents grass), cotton balls (represents sandbags), tongue depressors (represents retaining wall), sponges and bolts (represents trees), paper towels, a watering can, and a water bucket in the center of the classroom for the demonstration. I also need to make a copy of the Lesson 10 Notebook Sheet for each student

Materials: Materials will include cotton balls, tongue depressors, toothpicks, sponges and bolts, paper towels, 1 planter tray, sand, 2 large plastic cups, watering can, 1 wood block
Safety Considerations: There are no potential safety concerns for the students, as this is a collaborative and interactive demonstration.

Intended Learning Outcomes/Objectives:
Objectives: Students will be able to use evidence to optimize an original design to save the sand towers by considering the effect of changing one component.
Students will be able to communicate how the final design attempted to solve the problem of saving the sand towers by keeping them stable.

Student Assessment: I will summatively assess student's ability to change their original sand castle design to see if students were able to look at their evidence critically and find where they could improve their design to save the castles. I will be formally assessing the students' ability to communicate their thought process effectively with peers and to me.

Activities/Procedures:
Use of learning cycle in planning should be evident; Lesson should be described principally in terms of what the students' are doing in the lesson; Anticipated teacher questions and student responses should be evident THROUGHOUT THE LESSON PLAN; Including anticipated student responses will help in planning.

FOCUS – I will start by reintroducing the engineering design challenge to the students and reading the prompt that they worked with the day before. I will tell students that this is the last chance they have to save the sand castles and that they are responsible for testing another design using the same materials they used the day before. I will ask students what they thought went well for them yesterday and what they think they could have done better if given another opportunity. I will ask students if they have any questions about the activity and remind them that they can only use spend $100, so if they want to change their materials, it must be under the allotted amount.

Transition: I will tell students that each student will have the opportunity to share a way that they think we could improve our design from the day before. I will tell students that there is an easy way to make the original design even better than it was the day before. I will show them a picture of what a retaining wall can hold back during a storm and remind them of the importance of placement

EXPLORE – During the explore time of the lesson, students will review their packets from the day before and see what they can do to improve upon their design for today's experiment. Students are going to draw how they will improve their design from the day before and then we will see which student has the best design for the whole class to do

together with the teacher design. Students will share how they have improved the original design and based on a class vote, we will decide which design we do as a class. I will call students up to the board to draw the design on the board so the whole class knows what we are testing. I will place the reinforcers in the right spot of the sand-fiilled panter tray, based on the drawing we made as a class, and will have my watering can full of water. I will place my watering can at the top of the sand tray and will pour water for 10 seconds. Students will have to observe what they saw happen to the sand and determine if the sand towers were saved.

REFLECT – We will talk as a group to see if our new design saved our sand towers and students will work with their tables to answer questions 1-3 on their worksheet. Students will share their answers to questions 1-3 and decide if we were able to save the sand towers with our new design. We will talk about what we could do differently if we had a third chance to save the towers.

APPLY – After all students are able to share, I will ask some reviewing/extending questions to expand student's thinking. I will ask students how we are able to stop soil and sand from washing away.

Lesson Closure: At the end of the lesson, we will talk about what erosion is as well as what engineers do to review what we have done throughout the unit.

Lesson Assessment: Students turned in their completed packet from the unit so I could see what students have learned. I think this lesson specifically was able to prove student learning as well as see how students have progressed throughout the unit. This unit has exposed students to a broad vocabulary that would not have been used without introducing this concept of erosion.