Science Lessons for Grades 6-8

"Gone with the Flow"

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Discipline: Processes that Shape the Earth
Grade: 6 to 8

Standards
NSES.5-8.4

Purpose/Goal
Identify agents of erosion, describe the effects of erosion, and use concepts to solve novel problems associated with preventing the effects of erosion.

Context
Students might think water helps bind sediments to one another on a slope. Actually, water reduces the friction that holds sediments together. Because water lifts overlying sediments, friction is reduced, the slope becomes unstable, and mass movement or erosion takes place. Students should have a previous understanding of how rocks are weathered. In order to activate this prior knowledge have students make a list of ways in which they think weathered particles are moved from place to place. This lesson is tied into a series of lessons regarding weathering and soil formation.

Preparation
Teachers should make plaster blocks several days in advance using simple plaster of Paris from Home Depot or any store that supplies it. Pour the mixture into ice cube trays to ensure standard shapes and sizes. Let the trays sit and dry for at least 2 days on the counter. After the cubes have dried you may use a plastic knife and/or sand paper to whittle the blocks down to equal masses (30-35g). Make sure that the entire class has cubes that are equal in mass in order to increase the validity of the experiment. Create two erosion boxes for the classroom. The erosion box can be constructed using any easily available rectangular plastic container, such as a shoe box or drawer organizer. A "weir" (wall leaving approximately 0.5cm of space open at the bottom) is then fastened in place 2cm from the top. Approximately 1/3 of the way "down" the box, fasten a basket made of wire mesh (available at most hardware stores) with the open side facing the top edge of the box. The plaster blocks should be placed in the basket with their long edges placed against the solid wall of the box. When the box is in place in the sink, the water hose should be placed in the small area behind the weir so that the water then will spread out across the width of the box and flow over all blocks equally.

Websites
http://www.teachertube.com/search_result.php?search_id=erosion
http://www.sciencespot.net/Media/plateassign.pdf
Bill Nye the Science Guy Erosion 1 of 3
http://www.teachertube.com/view_video.php?viewkey=7fe2a1c54c1404863e64
This video clip is a great introduction for students to build concepts about the term erosion.

Description
Each group will be given three plaster blocks. The students will randomly assign their blocks to no flow, drip or low flow, and high flow. Each group will label a plastic cup with their group name and the words "no flow". The group will fill the cup 3/4 full of water and place their "no flow" block within it. Students should put this cup in an area where it will not be disturbed and allowed to sit until the next class period. Place the "low flow" blocks side by side in a plastic container with a small "weir"/wall in place and "grate made of egg crate of "field cloth". See diagram for clarity. The experiment works best if you use a sink with semi-rigid tubing that allows the water to go directly into the back of the setup (erosion box). Turn the water on to a low or high flow depending on the treatment being tested. The water should flow at a low rate in behind the wall and under and in-between the wall while moving past the blocks and out the other end of the erosion box. You can place a piece of cheesecloth

over the drain to catch the sediment from the blocks. This informs students that the block doesn't magically disappear, rather the sediment is transferred somewhere else. Repeat this setup with an increased rate of flow. Leave the water running in the two erosion boxes for 1-2 days depending on the length of time between classes. Remove the blocks and allow them to dry on the counter for 2 days. Using a balance record the mass of the blocks. Students will make observations of the blocks appearance/size and mass to determine the effects of water flow/mechanical weathering on erosion rates.

This project relates directly to an experiment performed by the resident scientist during her study on the effects of flow rate on coral growth. In order to perform her study, she built a spinning machine that corals could be attached to allowing them to experience different flow rates (based on their distance from the center of rotation) while being exposed to water that was identical in every other way (temperature, light, oxygen content, etc. While testing the machine (known as the "coral-sel" she used the "clod card" (dissolving plaster block) technique to determine whether the positions on the coral-sel were in fact experiencing water flow rates in the manner she expected. All blocks in high flow areas were expected to wear away at the same rapid rate, while blocks at positions closer to the center of rotation were expected to dissolve at rates slower than the "high flow" positioned blocks--at rates similar to all blocks at the same relative position from the center of rotation. This concept is related to erosion and weathering for the students.

Assessment
As a variation of a project of sciencespot.net, students will engage in various projects to demonstrate their understanding of the subject matter. Students will be expected to choose at least 40 points worth of work, but can choose up to 70 points if they need extra credit.

Follow-Up Activities
Considering that the plaster of Paris is porous in nature the students can take the pieces that were exposed to no flow and soak in water and put them in the freezer. The water that has gotten down in the cube will expand when frozen demonstrating the process of ice wedging. Take a small balloon filled with water allowing no air in the balloon. Cover the balloon with a thin layer of plaster of Paris and allow it to dry on a piece of wax paper for two days. Put the balloon into the freezer and allow enough time for the water to freeze. The plaster of Paris should crack due to the expansion of the frozen water. This demonstration also demonstration ice wedging which breaks down rock and is carried away as sediment through the process of erosion.