

The Changing Earth

Summary

The students will be able to use models to demonstrate the effect of mountain building, weathering and erosion forces on the surface of the Earth.

Materials

Invitation to Learn

- A small assortment of Duplo or Lego blocks

- Signs made on sentence strips

Centers Materials listed are for 6 teams to complete each activity at the same time. Materials may be adjusted if the activities are done as demonstrations or part of center rotations.

Earthquake Faults:

- 6 aluminum cake pans

- 12 pieces of fabric or plastic a few inches longer than the pans

- Bucket of moist soil

- Small items such as monopoly houses, Lego figures, small rocks, small sticks

Volcano model:

- 6 cardboard boxes (approx. 12" x 10" x 18")

- 6 squeezable ketchup bottle with a cone lid

- 6 feet of ¼ in inside diameter plastic tubing

- 6 Ziploc bags filled with 2 cups of soil each

- 6 Ziploc bags filled with 2 cups of white flour

- 6 aluminum cake pans

Wind boxes:

- 6 cardboard boxes (approx. 12" x 10" x 18")

- 6 Ziploc bags filled with 2 cups of dry sand each

- 6 8 oz. plastic cups

- 50 package of straws

- 12 pairs of safety goggles

- 6 balls of modeling clay

- Small items such as Monopoly houses, Lego figures, small rocks, small sticks

Minimountains:

- 2 kitty litter trays or plastic storages boxes

- Shovel

- Garden hose (or buckets to carry water)

- Watering can (or large jar with holes punched in the lid)

- Small items such as monopoly houses, Lego figures, small rocks, small sticks

- Access to soil and sod that can be dug up

Weathering and erosion scavenger hunt:

- Student journals

- Rulers and tape measures

- 1 digital camera per group (optional)

Background for Teachers

The surface of the Earth is constantly changing. Earthquakes, volcanoes, landslides, and flooding can make quick changes. Other changes, like weathering, erosion, and uplift happen slowly over long periods of time. It is often difficult for students to gain an understanding and appreciation of the forces

that shape and reshape the Earth, but by involving students in simulations and observations of local situations they can begin to see how these "forces of nature" affect their daily lives. Many of these simulations require the use of dirt and water. Some teachers may be reluctant to bring this mess into their classroom or do the necessary preparations, but to get students interested it is helpful to involve them in hands-on activities. One way to make the mess more manageable and minimize the preparation is to move outside. Find a corner of the playground where you can dig up some dirt. This may mean removing a small patch of sod, but it can be replaced when you are finished without causing too much damage. It is also important to get your students outside to explore their environment in search of the effects of weather and erosion. Therefore, you may want to plan to conduct your Earth studies during a season when the weather is most conducive to being out of doors.

Students love to be outside, but when you take the classroom outside they may need to be taught appropriate behaviors, because they may feel that since they are not in the classroom, recess behaviors are OK.

Intended Learning Outcomes

Observe simple objects, patterns, and events and report their observations.

Instructional Procedures

Invitation to Learn:

For this Invitation to Learn you will need a small bucket of Duplo or Lego blocks and the following signs for students to wear around their neck with an attached string:

Uplift (volcanoes, earthquakes)

Weathering Forces (ice, wind, abrasion, plants, animals, temperature change, water)

Erosion Forces (wind, water, gravity glaciers)

Call up two or three students and hang "Uplift" signs around their necks, and give them the bucket of Duplo or Lego blocks. Instruct them to build a mountain with the blocks. Give them a few minutes to work on the mountain while you explain to the class that these students represent the forces that build up high places on the surface of the Earth, or uplift. Uplift is caused by volcanoes and earthquakes. Write the words on the board.

After the mountain is completed, call up two or three students to be "Weathering Forces." Place the signs on the students and instruct them to break off parts of the mountain. They should not break down the whole mountain. The broken-off pieces should just be left lying near or on the mountain.

Next call up two or three more students, place the "Erosion Forces" signs on their necks, and have them carry the broken-off parts of the mountain and deposit them in other places in the room.

Introduce the terms *weather*, *erosion* and *deposition* and write them on the board. Explain that, like in this simulation, weathering breaks down rocks into smaller and smaller pieces. Ask the class to name forces that might be able to break apart the rocks that make up mountains. List their responses on the board. They should include ice, wind, abrasion, plants, animals, temperature change, and water.

Likewise ask students to name forces that could carry away the pieces of rock from the mountain. List their responses on the board. They should include: wind, water, gravity (causing landslides), and glaciers.

Next explain that the word *deposition* comes from the word *deposit*, which means to leave or drop. That's what happens to the pieces of rock that are carried as far as they can be by the erosion forces; they are dropped or deposited. This process is called deposition. Finally, write the word *sediments* on the board and explain that the pieces of rock and soil that are carried by the erosion forces are called sediments.

Instructional Procedures:

Begin by discussing each of the following three centers, one at a time. Demonstrate how each center

works, how it was set up, any safety concerns, and all core concepts that apply. Introduce the web sites and show video clips relating to uplift, volcanoes, earthquakes, faults, weathering and erosion. Divide the class into 6 teams and have them rotate through the 3 centers.

After the teams have completed the rotations, bring the whole group back together and have participants share what they learned at each center.

Earthquake Faults Center:

This activity models the action of a strikeslip fault like the San Andreas fault in California. This activity can be done as a demonstration, but it is much more engaging when done by cooperative groups of 3-5 students or as part of the center rotations.

Explain to the class that they are going to model a strikeslip fault. Spend a few minutes introducing or reviewing other types of faults. It is not necessary for students to memorize the names of all the fault types, but they should become familiar with the type of movements that occur along faults. The web site howstuffworks.com has videos, animations, and photographs that can be used to illustrate different types of faults. (See Resources below.)

Tell the class that the San Andreas Fault, a strikeslip fault, is the longest fault in California. (For more information on the San Andreas fault, see the Wallace Creek web site listed below.)

Give each group a shallow aluminum cake pan and the other materials. Have each team lay the fabric pieces sidebyside in the bottom of the pan with the ends hanging over the sides of the pan.

Give each team their dirt. The dirt should be patted down until it is firmly packed. Then the teams can build a road using a finger and placing other items in the dirt to represent houses, fences, trees, etc.

To make the earthquake, the pieces of fabric should be gently pulled in opposite directions. During the quake, have students look for the formation of ridges and sag ponds. Have the teams rebuild and try pulling the fabric at an angle and making observations.

Students should use labeled drawings and descriptions to record their observations in their journals.

Conclude the activity by allowing teams to share their observations with other teams.

Volcano Model Center:

Kids love volcanoes and volcano models are a staple of many elementary school classrooms and science fairs. This model doesn't explode, but it is an effective demonstration of lava flows that are responsible for the building up of volcanic mountains.

One model could be built and used as a wholeclass demonstration. However, it is much more engaging to have each cooperative team build a model, or use the model as part of a center rotation. Before having the students build their models, it is helpful to construct one to use as an example that students may refer to during the building process. Since it takes a day for the volcano to dry, complete the following steps the day before you plan to have your students make volcanoes.

Begin by cutting away one side of the box and making a hole in the top of the box and the bottom of the aluminum pan just large enough for the plastic tubing to fit through.

Put about 2 cups of dirt in a Ziploc plastic bag. Slowly add water to the dirt and knead until it forms a workable mud.

Push the plastic tubing up through the hole in the box and pan until about 4 inches is sticking above the pan.

Dump the mud into the pan and form a "volcanic mountain" around (but not covering) the tubing. Set the volcano aside to dry.

When you are ready to "erupt" the volcanoes, make the "magma." Give each team a Ziploc plastic bag with about 2 cups of flour. Have students slowly add water to the flour and knead until they have a smooth substance about the consistency of white glue. Add a few drops of red food coloring to the "magma" and knead it in.

Next cut off one corner of the bag and squeeze the "magma" into the plastic ketchup bottle. Put the lid on the bottle and push the point into the plastic tubing, making sure it fits tightly. Squeeze the bottle to make the "magma" flow up the vent and down the sides of the volcano. Have students make observations and record them in their journals using descriptions and drawings.

Discuss the models. How does each part of the model relate to the parts of a real volcano? What did you observe about how the "magma" flowed after it came out of the vent? What would happen if you increased/decreased the pressure on the bottle?

After the first "magma" flows have dried, allow the teams to do more eruptions over the next few days.

Wind Boxes Center:

Prepare each team's box by cutting off any top flaps and one of the ends. Put about 2 cups of dry sand into Ziploc plastic bags for each of the groups.

Begin by asking the students if they have ever been in a strong wind storm. Have students explain how it felt. Were there things being blown around by the wind? Was any damage done? What effect can the wind have on the surface of the Earth? Explain that the wind is one of the forces that breaks down rocks (weathers) and moves rocks and soils (erosion, sediments) on the surface of the Earth.

Give each team a box, bag of sand, plastic cup, goggles, and straws. Instruct them to put the sand in the cup and dump it into the box about 10 cm from the cutout end of the box. The sand should spread across the box from side to side, be formed into a ridge, and patted down until it is firm.

Place newspapers under the box on a table or on students' desks. Tell the class that they will be blowing sand and that they need to be careful not to blow too hard and get sand all over. They need to wear goggles to ensure they don't get any sand in their eyes.

Students will take turns being the blower and the feeler. The blower puts on a pair of goggles and holds a straw parallel to the bottom of the box, close to the top of the sand ridge, then gently blows on the sand.

At the same time the feeler puts on a pair of goggles and leans over the other end of the box and places his/her arm inside. The feeler should move his/her arm up and down and describe what he/she feels. Repeat until everyone has had the opportunity to be a blower and a feeler.

Ask: "At what level in the box was there more sand hitting your arm? Where do you think the most wind weathering and erosion happens, close to the ground or higher up?"

Have the teams rebuild the ridges at the front of their boxes. Give each team a ball of modeling clay and have them roll snakes about 10 cm long. The snakes should be placed in the bottom of the box at various places parallel to the sand ridge.

Students should then put on the goggles and take turns using a straw to blow on the sand.

Students should make observations and record them in their journals using descriptions and drawings.

Ask: "What formations were made in your boxes? What happened around the clay? On the Earth, what would take the place of the clay" (rocks, logs) "What would happen if you had more sand and just kept blowing?"

Lesson and Activity Time Schedule:

Each lesson is 55 minutes.

Each activity is 30 minutes.

Total lesson and activity time is 90 minutes.

Activity Connected to Lesson:

Minimountains:

This activity can be done inside, but to ease the amount of setup and cleanup time it is helpful to do it

outside. If you plan to do it inside, use 5gallon buckets to collect the dirt and sod, and spread a tarp on the floor.

This activity is done by making two mountains in kitty litter trays or large plastic storage boxes. Find a place on the playground or around the school where you can collect a few shovels full of dirt and a shovel of sod. If water from a hose is not available, you will need to carry a bucket or two of water from inside.

Take the class to the location on the school grounds; set the kitty litter trays on the grass and have the students form a semicircle. Make a minimountain in one tray by placing a couple shovels full of dirt on one end of the tray. Mound it up leaving space at the other end of the tray. This space is the lake.

Make another mountain in the other tray by placing a shovelful of sod in one end of the tray. Place the sod so that the grass surface is on an angle. Make sure to leave a space in one end of the tray for a lake.

Make the erosion monitors by sticking a popsicle stick at the top of each mountain and every few inches down the side of each mountain. Each stick should be about halfway into the mountain. Using a permanent marker, draw a line at the soil level on each stick.

Place houses, cars, trees, rocks, etc. on the slopes of each mountain.

Select a student to be the rain maker and have him/her sprinkle water from the watering can onto the first mountain. Instruct the students to make close observations as the rain falls on the mountain. Call on students to share their observations. Refill the can and have a student rain on the sod mountain. Make and share observations. Mark the new soil levels on the erosion monitors. Have students measure the difference in soil levels and record it along with a drawing in their journal.

To conclude, discuss the following questions:

What landform features were created on the soil mountain?

Why did the water collected in the lakes look different?

How did the shape of the mountains change?

How is this model similar to what happens in the real world?

How is it different? Explain that real mountains are not just piles of soil but are made of solid rock covered with rocks and soil.

Weather and Erosion Scavenger Hunt:

This activity can be used as an introduction to weathering and erosion, or could be expanded into a culminating group project for an Earth Science unit. (See Extensions.)

Before heading outside, divide the class into cooperative teams of 35. Tell the teams that they will be going outside to look for evidence of changes that have been made around the school by weathering and erosion. If needed, review or explain the forces that cause weathering and erosion; wind, water, ice, plants, animals, and humans.

Explain that they will be working as a team but each person will need to make his/her own journal entries using drawings and descriptions of what his/her team finds. Teams should also use rulers and tape measures to determine the size of cracks they may find in sidewalks, roads or buildings.

Take the class outside and send them out to complete their hunt.

When students return, have them share what they found. If time is available, take the class around the school and have each team show the class what they found.

Extensions

Provide the teams with a digital camera and have them take photos of the effects of weathering and erosion they find. Photos could then be made into slide shows or PowerPoint presentations.

Family Connections:

Have students look for the effects of weathering and erosion around their homes and neighborhoods, and add notes and drawings to their journals, or document what they see using a digital camera.

Assessment Plan

Observe students as they work. Make notes to indicate what areas students may not understand completely.

Score students' journals using a rubric.

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