On your erosion walk and while you were reading the cases, you may have noticed that the type of soil or other Earth materials can make a difference in how and when erosion occurs. In this section, you will investigate several different types of soil and materials to see how water and gravity affect their erosion.

Your class will complete two investigations. One half of your class will investigate the relationship between particle size and erosion. The other half will investigate the relationship between steepness of slope and erosion. Each group will collaborate to interpret their observations and then share their findings with the class. In this way, you will be able to learn from one another.

**Investigation 1: What Is the Relationship Between Particle Size and Erosion?**

You saw in the case studies you read that water is a very powerful agent of erosion. Many of the examples of erosion you saw on your erosion walk were probably caused by water. As water runs over Earth’s surface, it picks up and carries away particles of soil and other materials. Some particles...
are more easily carried by water than others. In this investigation, you will compare how different-sized particles are eroded by water. Particle sizes most easily carried by water will be most easily eroded.

**Predict**

You will be working with a mixture of sand, gravel, slate, and potting soil or native soil. Native soil is the soil you can find where you live. Which material do you think will be most easily carried by water? Which materials do you think will be more difficult for water to carry? Which material do you think will be most difficult for water to carry? For each, record your answer and why you think that.

**Procedure**

1. Obtain 1 cup of pre-wetted, mixed earth materials.
2. Dump the wet mixture near the center of one end of the stream table tray. Form it into a hill against the edge of the tray. Raise the end of the tray beneath the hill with a book.
3. Fill a clean plastic cup with water and slowly pour the water over the top of the hill.
4. Observe the erosion on the hill.
   - First, notice the sizes of the particles. Rank the materials according to the size of their particles, from largest (1) to smallest (4). Enter these numbers in the first column of your Particle Size and Erosion page.
   - Measure how far the particles of different materials spread beyond the hill. Record measurements in the second column of the table.
   - Observe the patterns of eroded material, and describe them in the next column.
   - Observe and describe how the hill was affected by the running water. Add this to the bottom of the page.
5. Drain the water from the soil, form the soil back into a hill against the edge of the tray, and repeat Steps 3 and 4. Do a total of 3 trials. Record the results for each trial.

Investigation 2: What Is the Relationship Between the Slope of the Land and Erosion?

The Laguna Beach case showed that water and gravity can work together to cause erosion. In Laguna Beach, there was so much rain that a cliff’s soil became thoroughly soaked with water. The water made the cliff so heavy and loosened the bonds between the particles of soil so much that the force of gravity caused whole parts of the cliff to come loose and fall downhill. This is called a landslide.

Water and gravity also work together in smaller ways to cause erosion. On your erosion walk, you may have seen examples of soil or rocks that looked like they had rolled down a hill. In this investigation, you will experience how water and gravity together affect the way earth materials move. You will construct hills on different slopes and identify how each responds to water falling on it.

Predict

You will be working with hills of sand at different slopes to see how each would be affected by rainfall. On which slope do you think materials will travel the farthest when water falls on it? On which slope do you think materials will travel the least far? Why?

Procedure

1. Obtain two cups of pre-wetted, fine sand.

2. Dump the wet sand near the center of one end of the stream table tray. Form it into a hill against the edge of the tray. Leave the tray lying flat on your desk (no additional slope).
3. Spray water gently on the top of the hill about 50 times. Try to spray the water on the hill the same way that rain would fall. During spraying, notice and record any movements of the sand particles on or around the hill in the Patterns of eroded material column of your Slope and Erosion page.

4. Continue spraying until the spreading of the hill slows or stops (about another 50 sprays).

5. Observe the erosion of the hill. Observe how far the particles of sand spread beyond the hill. Observe the patterns of eroded material. Observe how the hill was affected by the running water. Record your observations on your Slope and Erosion page.

6. Drain the water, form the soil back into a hill against the edge of the tray, and repeat the procedure, raising the end of the tray beneath the hill about 5 cm (gentle slope) in Step 2.

7. Drain the water, form the soil back into a hill against the edge of the tray, and repeat the procedure again. This time, raise the end of the tray beneath the hill about 10 cm (steep slope) in Step 2.

**Analyze Your Results**

**Finding Trends and Making Claims**

Your class has now collected data about how different materials are affected by erosion and how slope affects erosion. It is now time to interpret those results. To interpret means to figure out what something means. Interpreting results of an experiment means identifying what happens as a result of changing a variable. What happened to each of the different types of materials when the mixture was eroded by running water? How did the movement of particles of different materials compare? What spreading patterns could be observed? How did changing the steepness of the hill affect the rate of erosion? How did the steepness of the hill affect how fast water flowed downhill? How did slope affect the distance the hill spread and the amount of sand carried to the bottom of the tray?

You will do two things to interpret your results. First, you will identify trends in your results. Then you will state a claim based on those trends. A trend is a pattern that you can see over several trails. A claim is your statement about what those trends mean. For example, you varied the slope to see if it affected the rate of erosion. Your data may have shown
that the finer particles in the mixture eroded faster than the larger particles over all the trials. This is a trend. Your claim would be the statement: “Finer particles erode faster than larger particles.”

Every time a scientist makes a claim, other scientists look for the evidence the scientist has for that claim. One kind of evidence is data collected in an experiment and the trends in that data. You will spend a lot of time in PBIS Units making claims and supporting them with evidence. You will be learning more about that later. For now, make sure that the data you collected matches your claim.

Make sure to record the trends you have identified on your Particle Size and Erosion and Slope and Erosion pages. Also include any claims you think you can make so you can share them with your classmates.

**Communicate Your Results**

**Investigation Expo**

You will now share with the class what you have found in an Investigation Expo. Remember, no groups in the class did both investigations. Therefore, others will need your results to complete the challenge. Read the box introducing Investigation Expos before moving on to make yourself familiar with what you will be doing in this activity.

**Introducing an Investigation Expo**

An Investigation Expo is like other presentations you have done, but specially designed to help you present results of an investigation. You will include your procedure, results, and interpretations of results.

Scientists present results of investigations to other scientists which lets the other scientists ask questions and build on what was learned. Scientists may present results by making posters and setting them up in large rooms at meetings with other scientists and their posters. They also give presentations about their investigations and results in front of large audiences of other scientists. Their presentations usually include visuals (pictures), showing all the important parts of their procedures and results.

To prepare for an Investigation Expo, you will usually make a poster that includes the same items that scientists’ do.
These include:

- questions you were trying to answer in your investigation;
- your prediction;
- your procedure and what makes it a fair test;
- your results and how confident you are about them;
- your interpretation of the results (conclusions).

If you think the test you ran wasn’t as fair as you had planned, report on how you would change your procedure if you had a chance to run the investigation again.

As you look at the posters and listen to other groups present their work, start with the groups that did the same investigation you did. Notice the similarities and differences in what they found and in their conclusions. If another group got different results, try to decide whose results are more accurate, yours or the others. If another group had different conclusions from yours, decide whether or not you agree with their conclusions and why.

When you look at the posters and hear the presentations of the groups that did the other investigation, make sure you get answers to all of these questions:

- What was the group trying to find out?
- What variables did they control as they did their procedure?
- Is their data consistent?
- Did they run their procedure the same way every time?
- What did they learn?
- What conclusions to their results suggest?
- Do you trust their results? Why or why not?

During the presentations, make sure you understand the procedure each group followed and that you agree with each group’s conclusions. If you do not hear answers to all the questions, if the answers are not clear, or if you think a group made a mistake, ask questions. Be sure to ask your questions respectfully.
Different Kinds of Variables

As you designed and ran your experiment, there were several kinds of variables you worked with:

- One that you changed or varied in your experiment. This is called the **independent variable** (or **manipulated variable**).
- Some were ones you worked hard to keep the same (constant) during every trial. These are called **control variables**.
- Some were ones you measured in response to changing the manipulated variable. These are called **dependent variables** (or **responding variables**). Their value is dependent on the value of the independent or manipulated variable.

Experiments are a very important part of science. When scientists design experiments, they think about the things that might have an effect on what could happen. They then identify exactly what they want to find out more about. They choose one factor as their independent (manipulated) variable. This is what they change to see what happens. They have to keep everything else in the procedure the same. The variables they keep the same, or hold constant, are control variables. Finally, there are factors they measure. These are the dependent (responding) variables. If they have designed a fair test, they can assume that changes in the dependent (responding) variables result from changes made to the independent (manipulated) variable.

If you ran Investigation 1, your independent (manipulated) variable was the type of material. If you ran Investigation 2, your independent (manipulated) variable was slope. In both experiments, your dependent (responding) variables were the distance the materials spread, the patterns of erosion, and the effects on the hill. Everything else, including the shape and size of the test container, amount of material tested, amount of water poured on each sample, and the way the water was poured, were control variables. To be sure that what was measured (the dependent or responding variable) was dependent on what was changed (the independent or manipulated variable), it was important to keep the controlled variables exactly the same every time a trial was run.
Reflect

Answer the following questions. This will prepare you for a class discussion about what you now know that will help you achieve the Basketball-Court Challenge. Be prepared to discuss your answers with your class.

1. What variable were you investigating in your experiment? What were you investigating about that variable? How did you vary it to determine its effects?

2. List all of the variables you tried to hold constant in your experiment.

3. How many trials did you perform? Why did you perform that number of trials? Was this a good number of trials?

4. For those who did Investigation 1: How consistent was your set of data? Why is consistency in repeated trials important in an experiment?

For those who did Investigation 2: How consistent was your data with the data of other groups who ran the same investigation? Why is it important for your data to be consistent with the data collected by other groups?

5. How useful was your data in determining the affect of your variable on erosion?

6. What do you think you now know about the effects of particle size on erosion that will help you design a way to control erosion at the basketball court? What do you think you know about the effects of slope on erosion that will help you control erosion at the basketball court?
**Slope, Particle Size, and Erosion**

Erosion moves soil and other particles. Force is needed to move anything; the main driving force of erosion is gravity. Gravity can move sediments by acting on them directly. Pieces of rock on cliffs and steep slopes, broken loose by weathering, fall or slide downhill under the direct influence of gravity. Gravity can also move sediments by acting on them through agents of erosion. If water runs downhill under the direct influence of gravity, the running water can then exert an indirect force on rock particles in its path, causing them to move. The running water is an agent of erosion. Other agents of erosion include winds, glaciers, waves, and ocean currents.

The faster water moves, the more force it can exert. With more force, water can move more rock particles and larger ones. The speed at which water flows downhill is directly affected by the slope, or steepness, of the land. The steeper the slope, the faster the water flows downhill, and the greater its power of erosion.

Water moving at different speeds can move different-sized particles. If water moves at 50 cm/s, it exerts enough force to move sand particles (and anything smaller) but not pebbles. At that speed, with water flowing over a mixture of sand and pebbles, the sand will be carried downstream, but the pebbles will be left behind. This way, running water can cause a mixture of different-sized particles to become sorted, or separated, according to their size.

**What’s the Point?**

Your class completed two investigations to answer two different questions. One half of the class collected data about how particle size affects erosion of soil and other materials. The other half of the class collected data about the effects of slope on the erosion of soil and other materials. Each group then interpreted their results by identifying trends in the data and stating a claim based on those trends. When everyone was finished, each group shared what they found in an *Investigation Expo*. By sharing results, everyone was able to get the information needed to answer both questions. This is the way scientists work. Presenting results of investigations to other scientists is one of the most important things they do. This lets other scientists build on what they learned. You interpreted the data from your investigation. The trends you found and the claim you made will help you in achieving the *Basketball-Court Challenge*. 