

FOSS® PEBBLES, SAND, AND SILT TEACHER PREPARATION VIDEO TRANSCRIPT

<Larry Lowery Introduction to FOSS Program>

Lowery: Hello. Welcome to the Full Option Science System. This program was funded by the National Science Foundation. Its goal was to develop materials that would involve youngsters with both the processes and the content of science.

The program is developed with the Lawrence Hall of Science, with scientists, science educators and teachers working together as a team to develop the materials. The materials are tested in the hands of teachers and children in classrooms. It takes about two years to turn out a module.

Each module begins with firsthand experiences. This is done because it has been found that firsthand experiences are the best way for youngsters to learn about the concepts of science. As the module progresses, children are introduced to abstractions and reading materials. The sequence from firsthand experiences through reading materials is deliberate because it has been found that youngsters, when they have some experience before they read, learn and understand more from the reading. Authors of reading materials can then take youngsters to greater abstractions.

Trust the materials that you are getting acquainted with. They have been well tested. We have found that they work extremely well in the hands of all teachers and are effective for youngsters in learning about science.

<Sue Jagoda Introduction to Module>

Narrator/Sue Jagoda: Hi. I'm Sue Jagoda. I'm going to introduce you to the Pebbles, Sand, and Silt module. The Pebbles, Sand, and Silt module consists of four activities that introduce students to rocks and their properties. Most of the materials that you'll need to teach these activities are included in these two boxes. There's enough material in the two boxes to teach two classes of 32 students.

Make sure you check the inventory sheet before starting so that you know which equipment is consumable and which is permanent. This video will guide you through the steps you need to take to get ready for the activities and also show you some scenes of the students in the classroom. Make sure you check out the Teacher's Guide, though, for all of the details.

First you'll find the Overview folio which contains many helpful suggestions for getting started. In it are the national standards that are addressed in this module, background information on earth science, ideas for organizing your classroom for the investigations, suggestions for scheduling the activities and an overview matrix to help you plan the entire module and integrate it into other areas of the curriculum. In the Materials folio you'll find an Inventory List for the kit, lists of any materials you'll need to provide for the investigations, directions for preparing the materials and information on ordering any replacements.

The next four folios are the Investigation folios. These are the heart of the program. The first page gives you overview information. The At A Glance chart summarizes the investigation and helps you plan for assessments and extension activities. Next you'll find background information specific to the investigation. There is a section called Teaching Children About which gives you some insight into the research about how children think and learn.

Each investigation has several parts. For each part you'll find a materials list, Getting Ready section, and then step-by-step directions for conducting the activity with your students. The interdisciplinary section in the back of the folio has many ideas for extending the investigation into other areas of your curriculum.

You'll find the duplication masters in the next section. Here you'll find all the student sheets used in the investigations. There are lots of ways to assess your students' learning as they progress through the investigations. Read through the module Assessment folio at the back of the Teacher's Guide for more information about the Formative Assessments suggested for each session, End-of-the-Module Assessments and portfolio suggestions.

After the Assessment folio you'll find duplication masters to help you with the assessments. On the Anecdotal Notes you can record your students' insights or the difficulties they run into. The Assessment Checklist is used when assessing specific skills or concepts the students have learned.

In the kit you'll find a class big book and eight student books, the FOSS Science Stories for Pebbles, Sand, and Silt. These books are designed to be read periodically throughout the module after students have had the hands-on experience of the activities. The Science Stories folio in the Teacher Guide provides background information and follow-up activities.

Check out the Resources folio located near the back of the Teacher's Guide. This annotated list includes both fiction and non-fiction books for students, videos, software and teacher resources.

There are a few things to get ready that you'll use throughout the module. Make copies of the Anecdotal Notes and Assessment Checklist sheets for assessing student understanding during the investigations. Many teachers write in student names before making copies.

Word Bank and content charts are used to help students remember the new vocabulary and concepts they learn as the module progresses. Students will add to these charts at the end of each session.

<Investigation 1, Part 1>

Narrator: In Activity 1, First Rocks, students investigate several different kinds of rocks and begin to develop an understanding of the properties of rocks. In Part 1, they observe and sort three different kinds of rocks. These are the materials you need from the equipment kit: You need the bags of tuff, scoria, and basalt, the hand lenses, a vial, zip bags, magnifying loops, paper plates and black paper. You need to cut the black paper in half before you distribute it to the students.

All you'll need to provide is a half sheet of white paper for each student and a piece of chart

paper. Right the title Rock Words at the top of the chart paper.

Before beginning this activity, you need to assemble a set of rocks for each student and one for yourself. A set of rocks consists of two of each of these kinds of rocks in a zip bag. These are all volcanic rocks.

This is basalt, a dark fine grained rock. This is scoria, a reddish rock with lots of holes in it. And tuff, a yellowish rock that's rather soft. This is one set ready to go.

Before you begin, you'll want to make copies of the Letter To Parents and send these home with your students. The letter describes what children will be doing in the coming weeks and encourages parents to help students look for rocks around their neighborhood.

Teacher: Who can tell me what are these objects that I have in this bag today?

Narrator: Begin the activity with a discussion at the rug. Hold up one of the rock bags and ask the students to identify the objects in the bag. Then explain that each student will get a bag of rocks to explore and sort. Distribute the rocks and allow about five to ten minutes for observation and sorting.

Student: This one is cool.

Narrator: The students should notice that there are three different kinds of rocks.

Teacher: When you looked at your bag of rocks, who can tell me how many different kinds of rocks you thought there were in your bag?

Narrator: Gather the students at the rug and discuss their findings.

Teacher: Okay. Daisy, how many did you think there were in the bag?

Student: None because all of them were matches.

Teacher: So of the six rocks you had --

Student: There were two groups.

Teacher: So you had them in -- how many different groups did you have?

Student: Three.

Teacher: You had three groups.

Narrator: Hold up a sample of each kind of rock one at a time and have the students supply words to describe the rocks. Record their responses on the Rock Word chart.

Teacher: Does anybody have another word to describe the surface, the way the rocks felt? We have smooth and bumpy. Any other words to describe that you thought in your mind?

Rami, how did your rocks feel?

Student: Some of them were hard.

Teacher: Okay. You mean -- did you tap them on something or did you just feel them with your fingers.

Student: Just feeled them.

Teacher: And so they felt hard?

Narrator: Suggest that the students might find out more if they rub the rocks together. Suggest that they first rub similar kinds of rocks together over both colors of paper and observe what, if anything, comes off the rocks. Then they should rub different kinds of rocks together. After about ten minutes, gather them back at the rug and discuss their observations.

Student: It had little bitty of -- it looks like gold.

Narrator: After the discussion, collect the rock dust from each cluster on a paper plate and transfer all of the dust into a vial. The students can observe the dust later at the magnification center. This is the end of Part 1.

<Investigation 1, Part 2>

Narrator: In Part 2, students find out what happens when they get the rocks wet. These are the materials you need from the equipment kit: We've already put together the rock sets in Part 1. You also need hand lenses, one for each pair, and plastic cups, one for each pair.

You'll need a basin from the kit for collecting water at the end of this activity. All you need to provide are paper towels and water. You need to make a copy of the Rock Record sheet for each student before starting this activity. You should also review the Rock Words duplication master and decide whether you want to make a copy of it for each student to help them with recording. You should also make sure you have the Rock Words chart that you started in Part 1 available for the students to use.

Begin Part 2 with a class discussion at the rug. Explain that today's activity involves placing the scoria, the salt and tuff in water and observing what happens. Each pair of students will get a half cup of water in which they will place their rocks one at a time.

Student: Oh, cool. Look. Oh . . .

Student: This comes off. Well, look. Wait; wait.

Narrator: Encourage the students to describe any changes they observed.

Teacher: Did anything happen to the color of the rocks?

Dominic, when you put a rock in, did anything happen to the color?

Student: The black went in and I washed it off and it turned red.

Teacher: Is the red the same now as it looked before or is the red different?

Student: The red is different.

Teacher: How is it different?

Student: Because this used to be kind of purple.

Narrator: When students have finished their observations, remind them to place the rocks on the paper towels to dry.

Teacher: Did anybody do anything with the red rocks?

Narrator: Bring the students back to the rug to share their observations and brainstorm rock words. After the discussion, have each student complete a Rock Record sheet for at least one of the rocks. They can use the class Rock Word chart or the Rock Words sheet to help them with spelling.

Make sure the rocks are completely dry before you re-bag them. If the rocks aren't totally dry, some of the rocks, such as the scoria, may begin to sprout unexpected life. Sorting and re-bagging the rocks is a good student activity.

<Investigation 1, Part 3>

Narrator: In Part 3, students observe and sort a new set of rocks. These are the materials you need from the equipment kit: You need plastic cups, hand lenses, zip bags and the bag of large pebbles. You'll also find a copy of the book "Peter and the Rocks" in the kit. Notice it's printed in both English and Spanish.

You need to provide water and paper towels or sponges. You need to assemble some new rock sets before starting this part. Count out 20 large pebbles and place them in a zip bag. Make one rock set for each pair of students and one extra set for yourself. Begin this part with a discussion about what the students have learned about rocks so far. Then read the book "Peter and the Rocks" to the class.

Teacher: Tiny flecks that look like glass were stuck in the rock. Peter began to wonder if all rocks had hidden surprises.

And these are rocks that we found at the bottom of a river.

Narrator: Bring out your bag of river rocks and show them to the students. Explain that they are called river rocks and are the kind of rocks you might find on a river bottom. Explain that each pair of students will get one bag of rocks and it's their job to divide the rocks so that each person gets a fair share. Then their task is to begin sorting their rocks into groups in as many ways as they can think of.

If a student has a problem getting started, suggest sorting the rocks into light and dark colored groups. After a while suggest that the students might use water once more for washing the rocks.

As they wash the rocks, have them describe any changes they see in the rocks. When the students have finished washing their rocks and sorting, call them back to the rug for a discussion about their discoveries.

Student: Two gray ones.

Narrator: After the discussion, have the students set the rocks out to dry. When the rocks are dry, have the students help you repackage them into sets of 20 rocks each. This is the end of Part 3.

<Investigation 1, Part 4>

Narrator: In Part 4, students use the river rocks and sorting mats to play some games. If you think your students have had enough sorting experience for now, schedule this activity as a review at a later date. You're going to need the rock sets that you put together in Part 3, one for each pair, and one double sided sorting mat for each pair.

To prepare the sorting mats, you'll need to duplicate copies of Sorting Mats Side 1 and Side 2. Copy the masters back to back. You can laminate these or slide them into plastic sheet protectors to prevent them from getting wet. You'll need to make transparencies of the sorting mats if you plan to use them in demonstrating the games.

To begin this activity, review the story of "Peter and the Rocks" and discuss how he sorted his rock collection and how the students sorted their sets of river rocks. Then introduce these sorting games. One game involves having one student choosing a rock which she places in a column on the sorting mat. Then her partner chooses another rock that shares one property and places it next to the first rock.

This rock is the same size as that rock. This one is white just like that one. This one is sparkly. This game continues until there are two full columns. Another game has the students sorting the rocks by one property and organizing them into a graph.

Here we've sorted the rocks by size. Students can then use their graphs to answer questions like: Which size are there the most of? Which size are there the least of? Would you say there are a lot more small rocks than big rocks or just a few more?

Another game involves having one student choosing two rocks that go together and placing them in one of the circles on side 1. The other student tries to figure out what property or what's the rule the first student used to pair the rocks.

Student: Oval?

Student: No.

Student: They have crystals?

Student: No.

Student: They are bumpy?

Student: Yes.

Narrator: The students can also seriate their set of rocks by shape, size, texture and other properties. For example, they can place all of the rocks in order from lightest to darkest. Students can also use a crayon to draw shapes such as squares and circles in the spaces at the tops of the columns. Then they can sort the rock collection by shape.

<Investigation 1, Part 5>

Narrator: In Part 5, students begin to organize their own classroom rock collection. From the kit you'll need zip bags for the students to collect rocks and hand lenses or magnifying loops for them to use at the learning center. You need to provide chart paper and marking pens and pencils or crayons.

You can begin this activity as soon as students start bringing in rocks to share. To begin the activity, have a class discussion about where to look for rocks and review "Peter and the Rocks," if necessary. Then tell the class that they are going to have the opportunity to start their own class rock collection and everybody gets to bring in two or three rocks to add to the collection, whether they collect them on a class field trip or bring them in from their own collections at home.

Discuss the rules for rock collecting and record them on the class chart. For example, rocks shouldn't be too big. They shouldn't be too valuable. And everyone gets to take their rocks home when their rock study ends.

Have the students complete Rock Record sheets for at least one of their rocks. You can also encourage the students to take turns organizing the collection in different ways. Consider having students create geologist toolkits to keep track of the techniques they used to explore earth materials.

On each page students describe how they can use the particular technique or tool. There is a pocket on each page to put a picture of the tool. When completed, they take these home to share with their families. Details for making the geologist toolkit can be found in the Interdisciplinary Extensions section of Investigation 1. The master sheets for the toolkit are located at the end of the investigation duplication master sections.

Here are the concepts that students have been introduced to throughout the investigation: Rocks have a variety of properties including color, hardness, shape and size; rocks can be sorted by their properties; rocks are all around us; rocks are the solid material of the earth.

Now that the students have had experience with these concepts, you can introduce the FOSS Science Stories. Your students will naturally be curious to learn more by reading the Science Stories and other books.

<Investigation 2, Part 1>

Narrator: In Activity 2, students investigate a mixture of river rocks, learn some ways to separate the mixture and also learn the names of the different sizes of rocks. In Part 1, they are introduced to the rock mixture and learn to use screens to separate the rocks by size. These are

the materials you'll need from the equipment kit: You'll need a basin. You'll need the bags of large pebbles, small pebbles, gravel and sand. You will also need the screen sets, hand lenses, broom and dust pan, paper plates, plastic cups, the one quarter liter containers, large zip bag and a metal spoon.

You'll need a second basin for cleanup in Session 2.

Make copies of the Rock Size labels for each pair. Each pair needs a half a sheet, one of each label. If you're the first person to use this kit, you need to prepare the rock mixture. To do this, use a plastic cup to measure two cups of each of the earth materials into a basin. That's two cups of sand, two cups of gravel, two cups of large pebbles and two cups of small pebbles. Then before starting the activity, you need to measure out one half cup of the rock mixture for each pair of students.

Teacher: I have a cup of rocks and pebbles and things in there.

Narrator: Begin the activity at the rug. Show the students the rock mixture and describe it as earth materials that came from the edge of a river. Call the mixture river rocks. Explain that their job is to find out all they can about the rocks.

Distribute a cup of mixture, two paper plates and one hand lens to each pair and have each pair divide the mixture between their paper plates.

Student: Little white specs.

Student: Oh, look. A red rock.

Student: Oh my God, look. A rattle snake.

Student: This is neat because it's different colors.

Student: Whoa!

Narrator: After about five minutes, show the students how to fold their paper plates like tacos and funnel the mixture back into the cup.

Teacher: Leave your rocks right there and we'll talk about it in a minute.

Narrator: Then explain the rest of the activity to the class.

Teacher: Often when they want to build roads, other things is that they need to separate this mixture of rocks. And I'm going to ask you now, put your thumb up if you have an answer, how do you think we can separate these?

Student: Look at the size of them, the shapes and the colors and then put them in one little pile.

Narrator: After the students respond, show them the large mesh screen. Ask them how they might use the screen to separate the mixture. Listen to their answers and then show them how to put a paper plate under a quarter liter container and put the screen on top of the container before

they pour the mixture on the screen. Distribute one large mesh screen to each pair and have the students take turns using it to screen their rock mixture.

Teacher: Do it together with your partner. You need to keep it on the paper plate.

Lisa, what do you notice has happened?

Narrator: Then call for attention and, if necessary, return to the rug. Discuss what happened. Make sure to notice that the rocks that were larger than the holes in the screen stayed on top and the rest went through the screen into the container.

Now show the class the medium and small mesh screens. Discuss what might happen if they use these screens. Distribute the screens and two more containers to each pair and have the students start working.

Allow the students to work unguided. Their efforts may seem very unsystematic in the beginning but don't hurry them and don't be concerned about them getting it right the first time. If you think the students need some more practice with the screens, go ahead and plan another session or two with them or set up the screens as a learning center in your classroom.

If after 10 to 15 minutes the students are still having some problems separating the rock mixture, call them back to the rug and show them one way to do it. Put the plastic container on the paper plate and start with the large screen. Pour the mixture through the screen and shake it so you can get everything through that will fit through the holes. You might even have to rub it a little bit. Then dump the stuff that stayed on top of the screen into another quarter liter container. Try to get it all out.

Then start with another container and the medium screen. Shake that around and dump anything that stays on top of the screen into another container. Then finally, use the small mesh screen and separate the last bit of the mixture. You'll end up with four containers with four different sizes of rock in them.

Once your students have successfully separated the rock mixture, ask them to take a look at the rocks that stayed on top of the large screen. They are going to separate those rocks into two groups now. They are going to put the largest groups into the plastic cup. They should end up with five containers of sorted rocks. Now ask them to put the rock groups in order from largest to smallest.

Geologists have special names for the different sizes of rock. They will end up with pebbles. Here we have large pebbles and small pebbles. Next comes gravel. We have large gravel and small gravel. And finally, the smallest particle is sand.

Each pair of students is going to get a set of rock size labels which they'll place in the appropriate container. After the students have finished this task, have them dump all of their rocks back into the basin. This is the end of Part 1.

<Investigation 2, Part 2>

Narrator: In Part 2, students use a record sheet to reinforce the idea of grouping rocks by size.

These are the materials you'll need from the equipment kit: You'll need your basin of rock mixture, one vial, and one quarter liter container for each pair of students.

Make one copy of the Sand, Gravel and Pebbles sheet for each student. If you have an overhead projector available, it would be nice to make an overhead transparency for this sheet, too, for demonstration.

Teacher: This morning I've got a cup. And in the cup I've got lots of different kinds of rocks. And what I want to do this morning is I want to sort them.

Narrator: Begin this part with the review of the five particle sizes. Show the students the Sand, Gravel and Pebbles sheet. This is a good time to use the overhead projector.

Student: Pebble.

Teacher: Does this go in the gravel box?

Class: Yeah.

Narrator: Explain that each pair will get a container of rock mixture. Show them how to pick out a rock from the mixture. Then check to see if the particle fits inside the square labeled Sand. If it does, they place it in the circle labeled Sand. If not, they should try the gravel square. If it fits, the rock particle goes in the gravel circle. If not, they try the pebble square and so on.

Distribute the materials and have them start sorting the rock mixture. If the students are up for another challenge, have them draw a line to divide the pebbles and gravel circles and have them label the halves large and small pebbles and gravel. Then they can sort the rock mixture even farther.

If you would like, you can have the students make a permanent record on their student sheets. Have them use a small amount of white glue to attach three or four samples of each rock size to the sheet.

<Investigation 2, Part 3>

Narrator: In Part 3, students take a closer look at sand particles and discover a new particle that's even smaller than sand called Silt. These are the materials you'll need from the equipment kit: You need vials, quarter liter containers, paper plates, the bottle brush, hand lenses, Post-it labels, plastic spoons, sand and powdered clay.

You need to provide water, transparent tape and paper towels. Make copies of the Sand and Clay Drawings sheet, one per each student. To get ready for this activity part, you need to fill the vials two-thirds full with sand, one for each student. Keep the caps for later distribution.

Begin this activity part with a discussion about sand and where it fits into the range of rock sizes. Sand is the smallest particle of rock the students have looked at so far. Distribute a vial of sand to each student. Let them observe and after about five minutes distribute a paper plate and spoon to each student. Explain that they can pour the sand onto the plate and use the spoon for further study.

Demonstrate how to vibrate the sand on the plate to help them find out more about the sand. When you think they are ready, distribute a hand lens to each pair. If they place the hand lens directly on top of the vial, the sand at the bottom will come into focus. They should notice that sand grains are of more than one size, and the grains look just like pieces of rock.

Student: Whoa!

Narrator: Describe the procedure for adding water to the vials. Use the paper plate to funnel the sand back into the vial. Add water to the vial as students observe. They should watch what happens to the water and sand without touching the vial.

When the water reaches the bottom, you will distribute a vial cap which they can put on the vial. They shake the vial and observe. Remind the students not to drop the vials on the floor or knock them against any hard surfaces because the vials can crack. Students write their names on Post-its to label their vials. They then let the vials sit overnight.

On the next day call the students to the rug and remind them that they shouldn't shake the vials today. Show them the Sand and Clay Drawings sheet. Show them how to write the word Sand under the left vial outline. Explain that they should draw what they see in the vial within this outline of the vial.

When they have completed their drawings, have them return to the rug with their drawings for class discussion. Talk about the layers they see in the vial and the position of the sand. Introduce the word silt to describe the fine material now deposited on top of the sand. Explain that silt is a particle of rock much smaller than sand.

Encourage the students to label the layers on their drawing sand, silt and water. They might identify the empty space at the top of the vial as air. When they've completed their drawings, keep the sheets for use in Part 4.

Now you can give each group a quarter liter container and show them how to carefully pour the water off of the vial leaving the sand and silt behind. You might lose a little bit of the silt. But after most of the water has been poured off, students can stick their finger in the vial to feel the silt and actually pull some out to rub between their fingers.

Now it's time for cleanup. Have several students help you out with this process. Show them how to add water to the vials, shake the vials up and then pour the contents into the basin. There's a bottle brush included in the kit to help you with cleaning the vials.

The sand isn't consumable so you need to save it for the next time you're going to use the module. After the sand has dried a bit, check to see if there's an observable layer of silt on top. If not, add about a quarter of a cup of powdered clay to the sand. Then it will be ready for the next use.

<Investigation 2, Part 4>

Narrator: In Part 4, students investigate a new particle size of rock, clay. These are the materials you need from the equipment kit: You'll need vials, moist clay, bottle brush, Post-it labels,

plastic cups and a basin.

You need to provide paper towels, water and a knife or string for cutting the clay. You need to cut the clay into one-inch cubes, one cube per each student. To do this you can use either string or a knife. First cut a one-inch slab. And then from that slab cut one-inch cubes. Some teachers have also suggested using fishing line.

Then you need to place cubes of clay into plastic cups, one cube for each student in the group. The students will also need the Sand and Clay Drawings sheet they started in Part 3. Make a copy of the Bottle Drawing assessment sheet for each student.

Part 4 begins with a discussion about a new earth material. Don't call it clay yet. Each student is going to get a cube of this new material to investigate and find out all they can about it.

Student: Should I put it in a ball or a square?

Student: Same with mine.

Student: Same with mine.

Narrator: After a few minutes of exploring the new material, call the students back to the rug to discuss their findings. Confirm that the material is, indeed, clay. Remind the students that silt is the smallest material they have worked with thus far. Then tell them that clay is the size of rock even smaller than silt, so small you can't see the individual pieces. The dust that forms on their hands is actually dry clay particles.

The students now divide the clay into two balls, one large and one pea sized. The large ball will go back into the group cup and sit out overnight. The small ball will go into a vial with water.

Distribute the vials and water. After the students have observed a bit, distribute the caps and challenge them to shake the vial until the clay ball seems to disappear. They may not have the endurance to do this.

Student: See my little ball.

Teacher: Is it getting foggy?

Student: Yeah.

Student: I found that out.

Student: Hey, it is getting foggy.

Student: I know. It looks like fog.

Narrator: When the students have finished shaking their vials, distribute the Post-its for labeling and have the students store the vials overnight. Tell them you will leave one ball of clay in a vial to sit overnight without shaking it at all to see what happens.

The next day the students observe what happened to the large balls of clay. You'll probably find they are as hard as rock or crumbly. Ask the student what they would do to soften the balls of clay again. Suggest adding water if they don't. Then have everybody put their balls of clay back and fill the cups halfway with water.

This is what it will look like after they've been sitting in the cup for about 10 to 15 minutes. While the large balls of clay are sitting in the water, have the students observe what happened in their vials. They will probably notice the water is all milky and there's a layer of clay down at the bottom.

Have them compare their vials to the one you let sit overnight. Remind them that you didn't shake your vial. They'll probably notice that the water is clear and there's crumbled clay down at the bottom.

Have the students complete the Sand and Clay Drawings. Remind them to write the word clay under the clay vial. Then have them compare the drawings of the two vials.

After the students have completed their drawings, gather a group of them together to help you clean out the vials. Use the bottle brush to get all of the clay out of the vials because you will be using these vials again in later activities.

Here are the concepts that students have been introduced to in Investigation 2: Rocks can be categorized by size; screens and water can be used to sort the sizes of earth materials; five sizes of rocks from smallest to largest are clay, silt, sand, gravel and pebbles.

<Investigation 3, Part 1>

Narrator: In Activity 3, students learn how people use earth materials to make things. In Part 1, students go on an excursion outside of the school building to find places where earth materials such as sand, gravel and pebbles can be found. All you need for this activity is a notebook, a clipboard and a pencil for recording students' observations.

Student: I'm telling.

Teacher: What is that? Is that a pebble?

Student: Oh.

Teacher: What is that?

Student: A rock.

Teacher: A rock?

Student: I got a piece of white rock.

Student: I see sand. And I also see a few pieces of gravel in here.

Teacher: And do you think this is made out of clay? Could there be clay in there?

Student: Yeah.

Teacher: What's underneath here?

Student: Dirt.

Student: Clay.

Student: I found clay.

Teacher: How do you know it's clay?

Student: Because I smushed it and clay is soft.

Teacher: And it sticks together.

Student: Huh?

Teacher: And it sticks together.

Student: Yeah.

Teacher: What makes the sand on the top different from the stuff on the bottom?

Narrator: Use the observations you've recorded on the clipboard to lead a class discussion on what the students found and where.

Teacher: What are the particles underneath here?

<Investigation 3, Part 2>

Narrator: In Part 2, they observe and compare three different grades of sandpaper. These are the materials you need from the equipment kit: You'll need paper plates, sand, small zip bags, hand lenses, loops and three grades of sandpaper: Fine, medium and coarse.

A duplication master called Sandpaper Texture Words is available in the Teacher's Guide. If you decide to use it, make several copies for the students to copy the words from. You need to provide half sheets of white paper and pencils or crayons.

To get ready, you need to prepare four bags of sand. Measure three-quarters of a vial of sand into each bag. The students will use their hand lenses to observe this sand. You also need to measure half a vial of sand onto two paper plates. Students will view this sand with the loops.

If you're the first person to use this kit, you need to tear a sheet of each grade of sandpaper into nine pieces. The easiest way to do this is to fold a sheet of sandpaper into thirds, folding it back and forth until you get a sharp crease. Then tear it along the crease. Then take the strip and fold it in thirds, again, making a sharp crease. Then tear it along the crease.

Teacher: I want everyone to look at their bag of sand --

Narrator: Students begin this part by reviewing the rock sizes and focusing in on sand. Each student gets a plastic bag of sand to observe with the hand lens. Then the sandpaper is introduced. Encourage the students to compare the sand papers by rubbing the different sheets gently with their fingers and by viewing the sandpaper through the lenses.

Students should notice that each sandpaper has a different texture. Introduce the words coarse, medium and fine to describe the textures. Give each student a pencil or crayon and a half sheet of white paper. Show them how to place each texture of sandpaper under the white paper and rub gently with the side of the pencil or crayon to make a permanent record of the sandpaper texture. Encourage them to label their drawings.

Students also enjoy challenging each other to identify the different sand papers with their eyes closed. This is a good opportunity to use the new vocabulary.

Student: That is medium.

Student: Yep, it is.

Student: Your turn.

Narrator: Have the students rub two sheets of sandpaper together over a piece of white paper to see what comes off. Encourage them to look at the material with a hand lens and compare it to the sand on the paper plate. During cleanup, have students sort the sandpaper into three piles. Save the sandpaper, the plates and the student rubbings.

<Investigation 3, Part 3>

Narrator: In Part 3, students mix sand with a matrix to make sand sculptures. These are the materials you need from the equipment kit: Two vials, a metal spoon, paper plates and two basins. You need to provide cornstarch, a pot for cooking the matrix, a spoon, a zip bag or some other container for storing the matrix, newspaper, white glue and clean sand.

You need about seven pounds of clean sand for this activity. Each student will need two vials full of sand to complete a sand sculpture. You can get this sand at a garden supply store, a toy store or an aggregate supplier. Now I'll show you how to make the matrix.

You need to mix equal amounts of cornstarch and water in a pot over low heat. Stir constantly. After about five to ten minutes, it should reach this consistency. Take it off the heat to let it cool. It will thicken as it cools. One batch should be enough for a whole class.

Begin this part by reviewing the properties of sand. Then introduce a matrix as a material that holds particles together. Each student gets a paper plate, two full vials of sand and a scoop full of matrix. They mix the sand and matrix together and begin sculpting.

Teacher: Well, when you're done with your sculpture, I want everyone to take a turn and look at the piece of sandstone because sandstone is made very similarly to the way your sculptures are made. It's held together with matrix. And I want you to take the hand lens and look at the top

side and see if you can see the bits of the sand that are held together and look at the sides. Take a good look at the sandstone with the magnifying glass.

Narrator: When they finish their creations, have the students move them to the drying station. A sunny window works best. It takes about two or three days for the sand sculpture to dry. If any pieces break off during the drying process, students can use a little white glue to reattach them. They have now discovered a way to hold sand grains together.

<Investigation 3, Part 4>

Narrator: In Part 4, the students use clay to make beads or pendants. These are the materials you'll need from the equipment kit: You'll need plastic cups and the moist clay. You need to supply water, scrap paper, straws, paper towels, newspaper and either string or a knife for cutting the clay.

You'll also need to supply painting supplies. You'll need paint and paint brushes. You also need to have yarn for hanging the beads.

There's enough clay in the kit so that each student will get a cube to make one bead. If you need to get more clay, make sure you get real earth clay and not modeling compound or play-doh.

Tell the students that they can make something with their clay that will hang on a piece of yarn like a bead or a medallion or a pendant. Let them mold the clay. And then as they get close to completing their creation, they should put a straw through the bead like this to make a hole for putting the yarn through later.

Now, let the bead dry on the straw. When the bead is dry, let them use paints to decorate their beads still keeping the bead on the straw. When everything is dry, they remove the straw and then put yarn through the hole. When they finish, they'll end up with something that looks like that.

<Investigation 3, Part 5>

Narrator: In Part 5, students make Adobe clay bricks. From the kit you'll need two basins, two cups and two metal spoons. You need to provide water, mini loaf pans, petroleum jelly, a bucket or a large grocery bag, clay soil, dry grass clippings or weeds and a garden trowel or shovel. You also need to provide pencils and scrap paper for labeling the bricks.

If clay soil is not available in your area, dig up some soil or muddy ground and add some powdered clay and water to it. Add enough powdered clay until the mixture holds its shape. This activity is best done outside where spills and cleanup are not a major concern. If you're going to have the students coat the loaf pans with petroleum jelly, have them do this before they get their hands dirty.

To make a brick, each student measures two cups full of soil into a basin.

Teacher: Can someone else have a turn? Good. Stop.

Narrator: As water is added, the students stir the mixture with their hands.

Teacher: There you go. Okay.

Narrator: They should break up any soil lumps and remove rocks. The proper consistency of brick mud is too thick to pour. Each student then adds one small handful of grass or straw, working it in thoroughly.

Teacher: Okay. Chris, put your grass in all the way.

Narrator: When the brick mud is ready, students can use their hands to put mud into the pans about two-thirds full. They press and pack the mud into the pan to form a flat, smooth surface. They can also gently tap the pan against a hard surface to level the mud.

Teacher: Does anybody need some more mud? Maybe you can share with Alisha.

Narrator: The bricks need several days to bake in a warm, dry location. Outside is best. But a sunny, warm window in your classroom will also work.

To label their bricks, each student should write their name on a piece of scrap paper and then set their brick on top of the paper. After the bricks have taken shape but are not thoroughly dry, students can dump the bricks out and pass the loaf pans onto the next group of brick makers. It will take about a week for the bricks to dry, depending on the heat and humidity.

Here are the concepts that students have been introduced to in Investigation 3: Earth materials are natural resources; the properties of different earth materials make each suitable for specific uses; earth materials can be used in a variety of constructions.

<Investigation 4, Part 1>

Narrator: In Activity 4, students put together and take apart soil. In Part 1 they are introduced to a new material called humus and prepare a recipe for homemade soil. These are the materials you'll need from the kit: You need quarter liter containers, the bottle brush, hand lenses, a large zip bag, one metal spoon, small zip bags, labels, plastic cups, the broom and dust pan, one basin, vials, paper plates and the sets of screens.

You'll also need these materials from the kit: Potting soil, gravel, sand and small pebbles. Make copies of the Soil Drawings sheet, one for each student. If you have an overhead projector available, make an overhead transparency of the Soil Drawings sheet, too. You need to provide water, transparent tape and paper towels.

To get ready, you need to prepare bags of humus. To do this, scoop up one vial full of potting soil into a zip bag. Make one bag of humus for each pair of students. You will also need to measure out the ingredients for the homemade soil ahead of time. You'll need two cups of small pebbles, two cups of gravel and two cups of sand.

Teacher: In my bag I have some new material.

Narrator: Begin the activity by telling the students you have a new material for them to explore. Show them a bag of humus. Each pair of students gets a bag of the material, which they should first observe through the bag. Then they can open up the bag a bit and smell and touch the

contents.

Student: Ewwww. It's gross.

Narrator: After they observe the humus for about five minutes, ask them to describe its appearance, feel and smell.

Student: There's a little sand in it.

Teacher: Oh, you found a little sand in it? Like the sand that we had when we were sorting pebbles and gravel? Did anyone find anything else?

Student: Some soil.

Teacher: You found soil?

Narrator: Tell them that the material is called humus.

Teacher: That's humus when you find pieces of bark.

Teacher: Now, what we have here, we have humus that you have in your bag. And I also have some other things. And we are going to make soil, man-made soil. And it's going to be homemade soil. And we have two cups of the gravel.

Narrator: Describe the soil recipe while holding up the ingredients one at a time and dumping each ingredient into the basin. Have the students add the humus to the mixing basin a few bags at a time. Let them help you stir the mixture.

Teacher: Jenny, bring your humus and pour it in.

Student: I want to mix it.

Narrator: Introduce the word soil as a mixture they just made. Define soil as a combination of earth materials like the sand, gravel and pebbles and decaying plant materials. The humus soil covers almost all of the earth's land surface.

Now that the soil is mixed together, the challenge for the students is to separate it back to its original ingredients. Each pair of students get a half cup of homemade soil and two paper plates. They observe the soil samples with the hand lens. They try to separate the soil by hand and by shaking the paper plate.

Students discover that it's fairly easy to separate the rocks by size. But it's difficult to separate the black humus from the rocks. Students will probably suggest using screens to separate the soil. Review how to use the screens and then distribute a set of screens and four quarter liter containers to each pair.

Let them have at it. Each pair should work with one sample of soil. They will probably find that the screens work fine for separating the rock sizes. But the humus clings tenaciously to each

particle size. After they have screened the soil, discuss the results.

Teacher: Were you able to separate the humus from all of the rest of the ingredients here, the rest of the sand and the pebbles and the gravel? Were you able to separate it?

Student: Yeah.

Teacher: Yes?

Student: Except for the humus. You can't separate the humus.

Narrator: If the students haven't already thought of it, suggest that they use water to try to separate the soil mixture. Provide little guidance for this investigation. Make the vials available at the materials station and let the students come up with their own plan for using water.

The instructions can be intentionally vague so you can assess how well students set up the procedure. Once the students have shaken some soil and water in a vial, have them let the vial sit overnight.

On the next observation day, review the soil components and the methods they tried to separate them. Then distribute the Soil Drawings sheet and have them begin drawing what they see in the vials.

Students will probably find that some humus is floating on top of the water in the vial and more is mixed throughout the other earth materials. You need to save the Soil Drawings sheets and the vials for use in Part 3.

<Investigation 4, Part 2>

Narrator: In Part 2, students go on a field trip to collect soil samples. You'll need these materials from the kit: Plastic cups and metal spoons. You need to provide pencils, scrap paper and transparent tape for labeling the soil samples.

Make sure you check with your principal or other staff who should be informed to let them know that you will be taking your students out on the schoolyard to collect soil samples. You should also find out whether there are any places where students shouldn't dig.

If your school doesn't have any suitable sites, assign soil collecting as homework. Give each student a zip bag for collecting about a half a cup of soil and a piece of scrap paper for labeling.

Before going outside with the students, explain the ground rules. The challenge is to find places on the school grounds where soil is located. Each pair of students will get one metal spoon in a plastic cup.

Each pair uses the metal spoon to dig up a soil sample from only one location. They need only half a cup of soil. And the pairs should decide where to collect the sample.

Student: Three.

Student: There's about a half a cup.

Narrator: Back in the classroom, students label and store the samples for use in Part 3. The labels should include their names and where they found the soil.

<Investigation 4, Part 3>

Narrator: In Part 3, students observe the soil samples they collected in Part 2 and try to separate them into their ingredients. These are the materials you need from the equipment kit: You'll need vials with caps, hand lenses, Post-it labels, the broom and dust pan and paper plates.

You will also need two basins for cleanup. You need to supply a pitcher of water and towels. The students will need their record sheets and vials from Part 1 and their soil samples from Part 2.

In this part students observe and separate the collected soil samples and compare these samples to the homemade soil from Part 1. Students should be in charge of the design of this investigation. Each pair should have access to paper plates, vials and water. You may also want to have the screen sets available in case students ask for them.

Allow the soil samples that have been mixed with water to sit overnight. On the second day, students record what they observe in the vial on the Soil Drawings sheet. After they've completed the drawings, ask the students to think of one thing that is alike about the two kinds of soil and one thing that is different. Then review what they found out about soil.

Have them repeat the ingredients that made up the homemade soil and the ingredients in their soil samples. They should discover that the type and amount of ingredients differ in soil from one location to another.

After you've completed this part, it's time to clean up the vials. Get a group of students to help you do this. Make sure you do it soon after you finish this part, otherwise, the organic materials in the vial will really start to smell.

Here are the concepts that students have been introduced to in Investigation 4: Soil is a mixture of earth materials; soils vary from place to place; soils have properties of color and texture; soils differ in their abilities to support plants; soils can be composed of humus and different amounts and sizes of rocks.

Your students have explored a variety of rocks and soils in this module. They have discovered that rocks and soils share some important properties. They also find out that rocks and soils can be very different from one another, depending on where they come from. But no matter where rocks or soils are found, both geologists and first and second graders make the same kind of observations when they discover a new kind of earth material.

Student: Whoa!