

Soil Stories

Second Grade Science Exploration

Students dig into dirt and discover the secrets of the intricate ecosystem living beneath their feet. After discovering soil's components, students take the next steps to become stewards of the soil.



SOIL STORIES

SECOND GRADE SCIENCE EXPLORATION

LIFE LAB SCIENCE PROGRAM



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Teacher Introduction

These exploration lessons are a product of the field trip program at Life Lab's Garden Classroom in Santa Cruz, CA and can be used in your own school garden or classroom.

Scoop up a handful of soil and you may see pebbles, grains of sand, bits of leaves and twigs, a piece of bone, and perhaps even an ant or earthworm. If you were to look at the soil through a microscope, you would find a busy world of tiny animals moving around and through the soil particles. Soil is crowded with living creatures, ranging from microscopic bacteria and fungi, to earthworms and millipedes, to gophers and moles. Soil provides the foundation for life on Earth. From the soil grow plants that provide food for people and other animals. Without soil, none of us could survive.

During their Soil Stories Investigation students dig and discover. They dig up a spadeful of soil and discover a dynamic mixture of living, once-living, and nonliving things. They practice sorting and classifying the tiny particles they find in soil. As they explore that spadeful of soil and compare it to soil from other places, they deepen their understanding of how soil is made. They also set up an experiment to test the water holding capacity of soil, and predict how soil structure will affect drainage. Students learn that the structure of the soil functions as a key factor in the lives of plants and animals living in it. They are all parts of a tightly linked system. Students experience a different side of soil when they use multiple senses to learn about how soils differ. They complete a fun language arts activity to link their soil studies to oral and written language. Then students perform stewardship tasks in the garden to "give back to the soil" for the health of the garden.



Science Standards

The California Science Standards listed below will be addressed during the Soil Stories Investigations.

EARTH SCIENCES

3. Earth is made of materials that have distinct properties and provide resources for human activities. As a basis for understanding this concept:
- Students know how to compare the physical properties of different kinds of rocks and know that rock is composed of different combinations of minerals.
 - Students know smaller rocks come from the breakage and weathering of larger rocks.
 - Students know that soil is made partly from weathered rock and partly from organic materials and that soils differ in their color, texture, capacity to retain water, and ability to support the growth of many kinds of plants.
 - Students know rock, water, plants, and soil provide many resources, including food, fuel, and building materials, that humans use.

INVESTIGATION AND EXPERIMENTATION

4. Scientific progress is made by asking meaningful questions and conducting careful investigations. As a basis for understanding this concept and addressing the content in the other three strands, students should develop their own questions and perform investigations. Students will:
- Make predictions based on observed patterns and not random guessing.
 - Measure length, weight, temperature, and liquid volume with appropriate tools and express those measurements in standard metric system units.
 - Compare and sort common objects according to two or more physical attributes (e.g., color, shape, texture, size, weight).
 - Write or draw descriptions of a sequence of steps, events, and observations.
 - Construct bar graphs to record data, using appropriately labeled axes.
 - Use magnifiers or microscopes to observe and draw descriptions of small objects or small features of objects.
 - Follow oral instructions for a scientific investigation.

Recommended Literature

Story Books

Amon, Aline, adap. *The Earth Is Sore: Native Americans on Nature*. New York: Atheneum, 1981. This is a collection of poems and poetic statements about earth and sky by Native Americans.

Baylor, Byrd. *Everybody Needs a Rock*. New York: Scribners, 1974. Find out how to hunt for a rock—no, the right rock.

Buchanan, Elizabeth. *Mole Moves House*. New York: Doubleday, 1989. An exuberant mole refuses to believe that his human neighbors think he is a pest.

Cole, Joanna. *The Magic School Bus inside the Earth*. New York: Scholastic, 1987. A special field trip on the magic school bus allows Ms. Frizzle's class to get a first-hand look inside the Earth.

dePaola, Tomie. *The Quicksand Book*. New York: Holiday, 1977. An adventure in the jungle leads to a discussion of the composition of quicksand . . . and rescue procedures. This book also tells how to make your own quicksand.

Dunrea, Olivier. *Deep Down Underground*. New York: Macmillan, 1989. In this counting picture book, garden animals present the numbers from one to ten, as earthworms, toads, ants and others march, burrow, scurry and scooch deep down underground.

Lobel, Arnold. *Small Pig*. New York: Harper, 1969. A pig who has had his pen cleaned up by the farmer's wife, goes off in search of mud and discovers that good mud is hard to find.

Peters, Lisa. *The Sun, the Wind and the Rain*. New York: H. Holt, 1988. The earth forms a mountain, shaping it with the sun, wind, and rain, while a child, in a parallel effort at the beach, makes a tall sand mountain also affected by the elements.

Romanova, Natalia. *Once There Was a Tree*. New York: Dial, 1985. This is a Russian tale about a decomposing tree.

Reference Books

Bourgeois, Paulette. *The Amazing Dirt Book*. Reading, MA: Addison, 1990. Two dozen activities dig up the dirt on dirt.

Coldrey, Jennifer. *Discovering Worms*. New York: Bookwright, 1986. This is a book about all kinds of worms—including where they live and what they eat. It includes ideas for collecting and studying earthworms.

George, Jean. *All Upon a Stone*. New York: Crowell, 1971. In a tiny community, a mole cricket tunnels, swims, and meets others of its species—all upon a stone.

Hess, Lilo. *The Amazing Earthworm*. New York: Scribners, 1979. The characteristics and habits of the earthworm are described clearly and simply.

Hiscock, Bruce. *The Big Rock*. New York: Atheneum, 1988. This book traces the origins of a granite rock located near the Adirondack Mountains, and describes how the rock reveals information about the Earth's history.

Keen, Martin L. *The World Beneath Our Feet: The Story of Soil*. New York: Messner, 1974. This teacher reference provides an introduction to soil—its formation, importance, and conservation; the various kinds of soil; and the plant and animal life found in it.

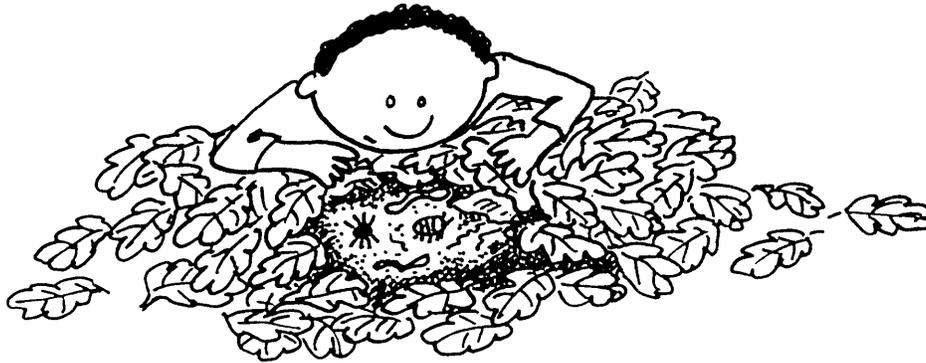
Leutscher, Alfred. *Earth*. New York: Dial, 1983. Another useful teacher reference, this one looks at the different types of topsoil such as clay, chalk, and sand. It also covers topics such as the elements that make soil, the growing conditions for plants, and fossils.

Maddern, Eric. *Earth Story*. Hauppauge, NY: Barron, 1988. This book illustrates the Big Bang theory of the universe's formation, and focuses on the formation of the Earth. It also briefly describes the development of topsoil.

McLaughlin, Molly. *Earthworms, Dirt, and Rotten Leaves*. New York: Atheneum, 1986. This teacher reference asks and answers the question, "What's so interesting about a slimy creature that lives in the dirt and eats dead leaves?" It includes a chapter especially on soil.

Schwartz, David M. *The Hidden Life of the Forest*. New York: Crown, 1988. An introduction to the animals, plants, and ecology of a forest, this book illustrates the rich interdependence of life in the forest.

The Hidden Life of the Meadow. New York: Crown, 1988. This is an introduction to the diversity and interdependence of plants and other living things in a meadow.



MASTER MATERIALS LIST: SOIL STORIES

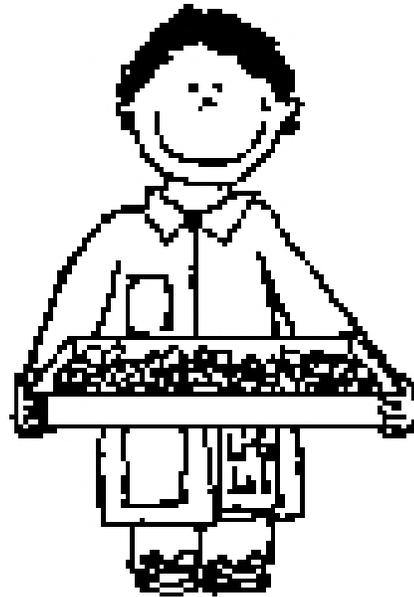
Sinking Into Soil

- 1 jar filled with soil from schoolyard or garden
- 2 large pieces chart paper
- Markers
- Drawing paper
- Colored pencils or crayons

Space Travelers

Per team of 3-4 students:

- 1 large sheet newspaper
- 2 trowels
- 1 egg carton
- 2 sets tweezers
- 1 hand lens
- Life Lab Field log and pencils
- Dissecting scope (optional)



Sensual Soils

- 4 containers with different types of soil:
clay, compost, garden soil, sand
- Scrap paper or sticky notes
- 4 lunch-sized brown paper bags
- 4 large pieces construction paper
- Colored markers

Does It Hold Water?

- Four lamp chimneys or plastic soda bottles with the bottoms cut off
- 4 moistened samples of very different soils: sand, clay, garden soil, compost
- Screen or cheesecloth
- Strong tape
- 4 quart jars
- 4 measuring cups
- Water
- Life Lab Field Log and pencils

Which Soil Do Plants Prefer?

For the class:

4 different types of soil in plastic bags: compost, clay, sand, garden soil
"Our Ideas about Soil" and "Questions we have about Soil" lists

For Each Group of 5:

4" pot filled with one of the soil types
1 large spoon
1 ruler
Label for pot
Marking pen
Bean seeds (Blue Lake or Bush Beans)
Measuring cups for water
Which Soil do Plants Prefer? Log Sheet

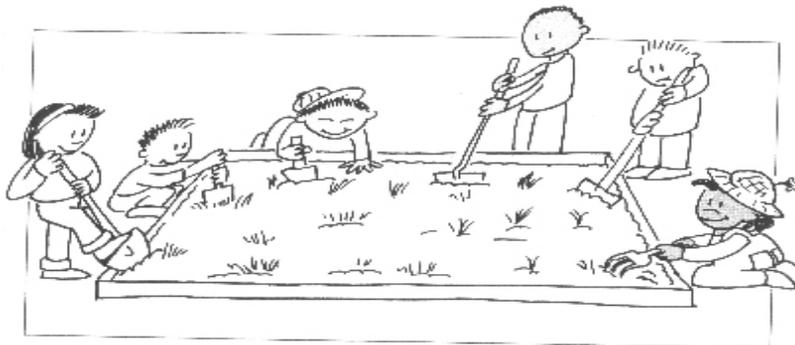
Great Book of Soil

For the class:

1 seedling or seed
Poster board for making the book cover
Cardstock or other material for book binding
"Our Ideas about Soil" list and "Questions we Have about Soil" list

For Each Student:

1 sheet of drawing paper with lines
Crayons or colored pencils



Sinking Into Soils

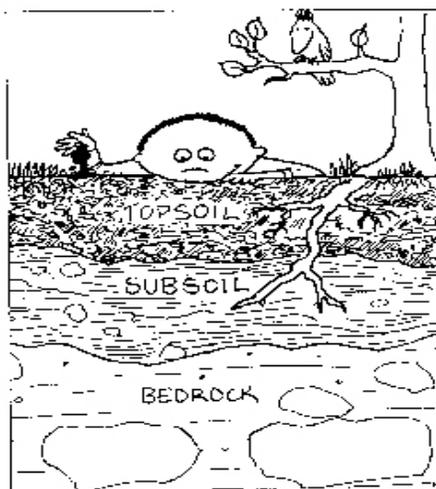
(Pre-Activity Assessment)

Description

Students draw their ideas of what is in soil in this pre-assessment activity.

Objective

To introduce the topic of soil and its importance, and to learn what students already know about soil.



Teacher Background

Many children have experiences with different soils, from making mudpies to sliding on the baseball diamond. What do your students really know about soil? What are their ideas about where it comes from and what it is made of? Their drawings and comments will provide you with information about what they are thinking about the nature of soil.

Materials

- 1 jar filled with soil from the schoolyard or garden
- 2 large pieces of chart paper
- Markers
- Drawing paper
- Colored pencils or crayons

Preparation

Make two lists with the pieces of chart paper: "Our Ideas about Soil" and "Questions we have about Soil." Post the lists where students can see them.

Class Discussion

Elicit students' ideas about soil by holding up the jar full of soil. What is the stuff in this jar? What is soil? How important is soil? Do you think all soils are alike? Why or why not?

Record all their ideas about soil on the first list.

Action

Ask the children to think quietly about a favorite outdoor spot. It could be any place they have been where they come in contact with the earth, such as on the soccer field or in the school garden. Ask them to imagine that they are very tiny, and they sink down into the soil. Distribute colored pencils and paper. Let them spend about 10 minutes drawing everything they might see in the soil, and the soil itself. What does it look like close up? What might they encounter on their trip into the soil?

Wrap up

Hang up the drawings next to the "Our Ideas about Soil" list. Give the students time to discuss how the drawings are alike and different. Add more student comments to the list, and record any questions they have on the "Questions We Have about Soil" list.

Challenge each child to bring a small soil sample from home to class. You may want to distribute a ziplock bag to each child with a note to parents attached. When all the samples have come in, allow students time to examine them and add comments and questions to their list.



Space Travelers

Description

Students work in small groups to decipher the composition of soil.

Objective

To explore what soil is made of.



Teacher

Background

Most people just call it “dirt” without thinking much about the contents of this life sustaining material. What IS soil? In this activity students will dig into various soils and try to analyze the contents. As they explore the surface soil (topsoil) they will discover many living things—roots, earthworms, insects, leaves. In addition, the topsoil contains humus, the high nutrient component of the soil formed by decayed organic matter. They will also discover the non-organic materials such as sand and rock particles. Soil is formed by natural forces that wear away rock and break it down. This wear can be caused by rain, wind, glaciation and the action of plants. Soil formation is a very slow process. It can take over 100 years to form one inch of topsoil!

Materials

Per team of 3-4 students:

- 1 large sheet of newspaper
- 2 trowels
- 1 egg carton
- 2 sets of tweezers
- 1 hand lens
- Field Log and pencils
- Dissecting scope (optional)

Action

Have the students sit quietly in a circle with their eyes closed. Read the following story:

Imagine that we are scientists from the planet Zog, journeying to planet Earth on the Star Ship Life Lab. We have been chosen to make a most important journey. The future of our beloved planet is in danger as it has become so polluted that we are no longer able to grow our own food. Our astronomers have detected a very faraway planet called Earth. It appears to be green, lush and fertile. Our computers have analyzed the reason for this and it appears to be a brownish-gray substance called "soil." It is difficult for us to believe that all their food comes from this substance. Our mission as scientists is to find this material called "soil," dissect it, and record each and every ingredient for our computers. This will allow us to learn the secret of this material so we can make soil back on planet Zog. Upon landing we will break into groups of 3-4 scientists. Each team will use the specially designed tools that our engineers have created just for this purpose. Remember: it is crucial to the success of our mission that each and every substance found in the soil be recorded. Good Luck to all of you. Long Live Planet Zog!

1. Divide students into groups of three or four. Tell each group that they will be researching the soil from a different part of the planet (garden). Demonstrate folding the newspaper into quarters and show how they can use one of the pockets created by the folds as a special place to store their soil sample as they carry it back to their work area. Show them how to dig up a sample of soil by inserting the trowel into the ground and lifting up a "pie slice" of soil. Remind them not to disturb planted areas.
2. Send each small group to a different area of the garden.
3. When they return with their soil, have them use the tweezers to gently pick up the different items in the soil. They can use the egg cartons to sort their finds into different categories. Have them record in their journals the different things they find.
4. Allow the groups to share their lists of soil ingredients. Are they all the same? If not, how do they differ?
5. Challenge the alien scientists to make some soil from the listed ingredients. Can they take rocks and bark and bits of leaves and make soil? Allow them to try until they get frustrated. Why can't they make soil in a few minutes? Explain that each inch of topsoil takes 100 years to form in nature. Bacteria, fungi, and other living things slowly decompose nutrients, recycling them into soil. Over 100 billion microorganisms live in a pound of soil. Our hands and tools cannot equal the power of the bacteria and fungi.

Wrap up

What is soil made of? Will the super computer on planet Zog be able to make soil? How is soil important to Earthlings' lives? Is soil alive? Do all materials in soil break down at the same rate? What would happen if all our soil washed away?

Sensual Soil

Description

Students use most of their senses to discover soil in this science/language-arts activity

Objective

To compare a variety of soils with the senses.



Teacher

Background

People often mask many of their sensory experiences, focusing only on the visual. In this activity, students are challenged to discover different types of soil using most of their senses, and describe it using words related to these senses.

Materials

- Four containers with different types of soil:
 - clay, compost, garden soil, sand
- Scrap paper or sticky-notes
- Four lunch-size paper bags
- Four large pieces of construction paper
- Colored markers

Preparation

Set out four containers of soil. Set paper scraps from empty paper bags and pens next to the containers.

Action

Tell the students that you will be exploring four different types of mystery soil, and using words to describe them. First they will use their senses to observe the soil without talking.

1. Pass the first container around without removing the lid. Allow students to shake it and listen.
2. Open the container slowly. Allow students to touch the soil with their fingers.
3. Ask students to put the container up to their nose and smell the soil.
4. Ask them to take a close look at the soil. They can rub a bit on some paper and look at the color and feel the texture.
5. Ask each child to say one word about the soil, based on one of their senses. Record each child's word on a sticky note or scrap paper. Put all the words in one bag. (Note: if a child can't think of a word, he or she may repeat another child's word.)

Repeat with each of the soil types.

After the students have experienced all four soils, explain that the group will now use all their words to create a poem about each of the types of soil.

Begin by opening one of the bags. Lay out all the scrap papers or sticky notes on top of the larger sheet of paper. Allow the students to move the words around until the poem has a pleasing sound. They must use every word no matter how often it appears. Ask them to give the poem a title. Repeat with the other bags of words. In the end the group will have created four poems to describe the four types of soil.

Wrap up

Which soil had the strongest smell? Which felt the weirdest? Which felt smooth and slippery? Which felt gritty and coarse? Which made the loudest sound? Which two were most alike? What did you learn about soils from this activity?



Does It Hold Water?

Description

Students time the passage of water through different soils to compare the water-holding capacity of the various soils.

Objective

To observe that soils hold water differently depending on their structure.



Teacher Background

Soil requires both water and oxygen to support plant growth. As water fills the spaces between soil particles, it drives out air, which can cause roots to rot. A good soil must be able to retain some water but allow for adequate drainage. An ideal garden soil is a balance of sand and clay.

Materials

Four lamp chimneys or plastic soda bottles with the bottoms cut off.
4 moistened samples of very different soils: sand, clay, garden soil, compost
Screen or cheesecloth
Strong tape
4 quart jars
4 measuring cups
Water
Field Log and pencil

Preparation

Set up the chimneys as in diagram. Add an equal amount of soil to each one. Label each of the soils.

Class Discussion

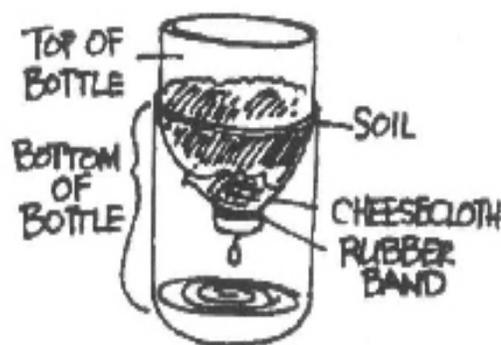
How can soils be different from each other? How can some of these differences affect how quickly water drains through soil? Do you think most plants like to sit with water around their stems? How can we find out which of these soils drains the fastest?

Action

1. Gather the students around the chimneys. Have them predict which of the four soils will drain the fastest and which the slowest. Have them record their predictions.
2. Designate 4 students to be the "pourers."
3. Designate any others to be timekeepers and recorders.
4. Have one of the time keepers give the signal to begin pouring.
5. At the signal each of the pourers should pour 250 ml of water into the soil.
6. Timers keep track of which soil the water percolates through first, second, third and fourth.
7. After the water has mostly run through the soils, compare the amounts left in the jars. Where is the water that is not in the jar? How much is left behind in the soil?
8. Ask student to test the drainage ability of the soils by saturating the soil completely with water. How long does it take the water to move completely through the jars? Record the results and compare with predictions.

Wrap up:

Which of the soils would you plant a seed in? Why? Which sample would you not plant a seed in? Could one of the soils possibly drown your plant? Which soil would be bad during a drought? How are soils different in their ability to hold water?



Which Soil Do Plants Prefer? (Post Visit Activity)

Description

Students plant seeds in three types of soil and compare results.

Objective

To practice setting up an experiment to test which soil helps a seed grow the best.



Teacher Background

After their trip to the Garden Classroom students should have lots of new ideas about soil to add to their lists. In this experiment, they will determine whether soil type makes a difference for a particular type of plant.

In nature, soil types greatly influence the kind of plants that grow in an ecosystem. Cacti seem to thrive in sandy soil while dandelions do well in heavy clay. Most gardeners and farmers amend their local soil to make it nutrient rich, easy to dig and well aerated for their crops.

Testing one variable alone is a hard concept for young children. They may be eager to “help their plant along” in any way they can. Remind them as the experiment progresses how important it is to treat all the seedlings equally so they can test which soil the plants prefer. A seed will sprout in many different conditions. It is important for students to follow this experiment for several weeks to see how the plant grows after emerging.

Materials

For the class:

- 4 different types of soil: compost, clay, sand, garden soil in plastic bags.
- “Our Ideas about Soil” and “Questions we have about Soil” lists

For Each Group of 5:

- 4” pot filled with one of the soil types
- 1 large spoon
- 1 ruler
- label for pot
- marking pen
- bean seeds (Blue Lake or Bush Beans)
- measuring cups for water
- Which Soil do Plants Prefer? Log Sheet

Preparation

Set up an area in the classroom where groups can work at tables covered with newspaper. If the weather permits, have students work outdoors.

Class Discussion

What new ideas does the class have about soils now that they have returned from their trip to the Garden Classroom? Ask them to verbally compare the four soil samples and discuss their merits based on what they have learned during their study. Which one would be best to grow a plant? Why? How could we test this? How can we be sure if it is a fair test? Do we need to plant all the seeds the same way? Why? How should we plant them? Do we need to water them in the same way? Why? How should we measure them? Write the agreed-upon planting, watering, measuring instructions on the board for everyone to see. (Help students make wise decisions so that they can compare the soils fairly. For example, if the students decide to water the seeds every day, they might drown them before they have a chance to sprout. The back of the seed packet will give good information on how best to plant the seeds.)

Action

1. Divide students into four groups. Assign each student a role. For example, Number One’s might be the Recorders, Number Two’s the Equipment Gatherers, Number Three’s the Planters, Number Four’s the Waterers, and Number Five’s the Labelers.
2. Distribute one pot with soil to each group. Ask each group to predict how well the plants will grow in the different soils. Have the Recorder record the group’s prediction, along with their reasoning as to why they think that.
3. Invite the equipment gatherers to collect the seeds, labels, markers, spoons etc. for their group.
4. Walk the groups through the planting steps the class agreed upon as the Planters plant the seeds for each group.

5. Instruct each Waterer to water their group's pot with the exact amount the class agreed upon.
6. Ask the Labelers to label their group's pot with the type of soil, the date and the type of seeds planted.
7. Place all pots in the same location, preferably in a sunny window, greenhouse or under grow lights.
8. Have each child recall and record the steps of the experiment on the log sheet.

Observe the pots daily with the students. Keep track of which seeds sprouted first, second, third, and fourth. After the seeds sprout, allow time every few days for groups to take measurements and record their seedlings size, color, number of leaves, etc. on their log sheets. Discuss how health of a plant can be measured in many ways, and size isn't always an indicator of the healthiest plant. Allow the beans to grow for a few weeks so students can see long-term effects of the soils on plant growth.

Wrap up

After three to four weeks, hold a final summit on "Which Soil Plants Prefer." Ask each group to present their findings about the health of their bean plant. Do the groups agree on which soil was the best for the plant? If not, how can they rationalize their arguments? Remind students that in science, the answers aren't always crystal clear. Often, experiments bring up more questions than they answer. What new questions came up for the group? (Add these to the class list.) Would they make any changes in how to do the experiment if they did it again? (We would love to hear their ideas. Please send these to us at Life Lab!)

Add any new information from the experiment to the "Ideas We have about Soil" list. Review the list and have each child relate something they have learned about soil to the group.



Which Soil Do Plants Prefer? Log Sheet

Names _____

Investigation: In which of the four soils will the bean seed grow the best?

Guess: (what we think will happen and why):

Test: (how we are going to find out):

Tell: (what we found out and what it means):

In which soil did the seeds sprout first? _____

Record the height of your group's plant each week.

Week 1: Our plant measured _____ cm.

Week 2: Our plant measured _____ cm.

Week 3: Our plant measured _____ cm.

Week 4: Our plant measured _____ cm.

Draw a picture of each plant after three or four weeks:

The Great Book of Soil (Post-Activity Assessment)

Description

Students create a class book to teach others about soil.

Objective

Students will communicate what they have learned about soil.



Teacher Background

This activity is designed to allow students to reflect on what they have learned about soil from the soil stories exploration.

Materials

For the class:

- 1 seedling or seed
- Poster board for making the book cover
- Cardstock or other material for book binding

“Our Ideas about Soil” list and “Questions we have about Soil” list

For Each Student:

- 1 Sheet of drawing paper with lines
- crayons or colored pencils

Class Discussion

Show students the seedling (or seed). Lead a discussion about what students might be able to tell the seedling about soil. Suppose this seedling could talk. What might you tell it if the seedling asked you, "Where should I plant myself? What is soil like? Does anything else live in soil? What does soil look like? What are some of the things you have learned about soil that you might be able to tell this seedling? Tell students they will be writing a book for seedlings.

Action

1. Review the lists the class made of their ideas and questions about soil. Show students where they added new information as they learned things in the course of their study. Discuss what things they learned about soil.
2. Demonstrate the activity by choosing one idea from the list and "telling" the seedling (or seed) about it. For example, "Soil has lots of nutrients to help you grow."
3. Have each student select an idea from the list to write about. Encourage the students to look at the seedling and talk to it as they write or dictate a sentence on the bottom of their paper.
4. Allow students plenty of time to illustrate their sentences.
5. Assemble the students' pages into a class book. You may want to create a "Dear Seedling" page as the first page of the book. Read the book to the class.
6. Ask students to name the book. Then call for a volunteer to draw the cover of the book.

Wrap up

Did we teach the seedling a lot of things about soil? Is there anything we forgot to mention about soil in our class book? What else would you like to learn about soil? Add these questions to the list.

- Leave the book in the classroom library for a few days and encourage children to read it on their own.
- Have students share the book with their reading buddies or a younger class.
- Let students take turns bringing home the book so parents and other family members can share what they learned about soil.



For more information, please contact the Life Lab Science Program (831) 459-2001
www.lifelab.org

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