

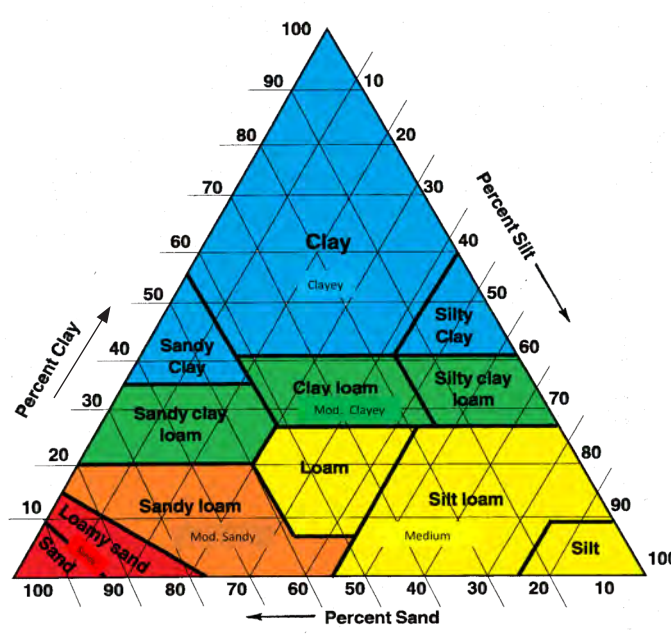
Soil Science Curriculum

Content and lab derived from the USDA-NRCS Guides for Educators. Go to www.nrcs.usda.gov/soils for the Guides and additional pictures and diagrams. This lesson plan was adapted for South Dakota from the University of Nebraska Institute of Agriculture and Natural Resources, CROPWATCH.

January 2018

Using Soil Textural Triangle

Approximately 45 minutes



The diagram is a ternary plot with vertices representing 100% Sand (bottom-left), 100% Silt (bottom-right), and 100% Clay (top). The plot is divided into 12 soil texture classes:

- Clay** (top): Clayey, Silty clay
- Sandy clay** (left side)
- Silty clay loam** (right side)
- Sandy clay loam** (left side)
- Clay loam** (center)
- Silty clay loam** (right side)
- Loam** (center)
- Silt loam** (right side)
- Sandy loam** (left side)
- Loamy sand** (bottom-left)
- Silt** (bottom-right)
- Sand** (bottom-left)

Objective
 By the end of the lesson, students will know or be able to:

- Use the soil textural triangle to distinguish between different types of soil

Preparatory Work

- Make necessary copies
- Review soil textural triangle use

Materials

- Soil Textural Triangle
- Guided Notes Page – one per student
- Guided Practice Page – one per student
- Answer key for teachers
- Three rulers or straight edges

Enroll the Participants - Use the Soil Textural Triangle to Distinguish between Different Types of Soil (Approximately 3 minutes)

Show a large picture of a Soil Textural Triangle to the class or give each student their own copy of the triangle. Ask if anyone has seen this before or how they believe it's used. Accept all answers until someone can identify it as a textural triangle used for determining soil texture.

Definition of Soil Texture

The weight proportion of the soil separates less than 2.0 mm in size (sand, silt and clay). Or, more commonly, the relative proportions of sand, silt and clay:

Sand = 2.0 to 0.05 mm

Silt = 0.05 to 0.002 mm

Clay = <0.002 mm

Sand, silt and clay in various proportions make up 12 soil texture classes

Using Soil Textural Triangle

Provide the Experience *(Approximately 5 minutes)*

Write the sample problem below on the board. Encourage students to work in small groups to determine the appropriate soil textural class. Allow groups to work together to solve the problem, wait until each group has determined the correct soil textural class.

Sample Problem:

75% Sand

15% Silt

10% Clay

Answer:

Sandy Loam

Congratulate students for their success in using the soil textural triangle.

Label the Information *(Approximately 10 minutes)*

After each group has successfully identified the soil textural class, explain to students that they will be writing a “How-to Guide” for this tool. In small groups, encourage students to write step by step instructions for using the soil textural triangle to accurately determine soil textural classes. After about five minutes, invite one group to share their “Soil Textural Triangle How-to Guide” with the class. Encourage each student to capture these instructions in their own words on their Guided Notes page.

Demonstrate the Relevance *(Time varies with students)*

Encourage students to work through the practice problems on the Guided Practice sheet. While students are practicing, move through the room offering support and encouragement to students that may find some challenges.

Review the Content *(Time varies with each group)*

When the majority of the class is finished, go through the problems as a group and check for understanding. Consider having each student provide an answer to ensure all students have grasped the material.

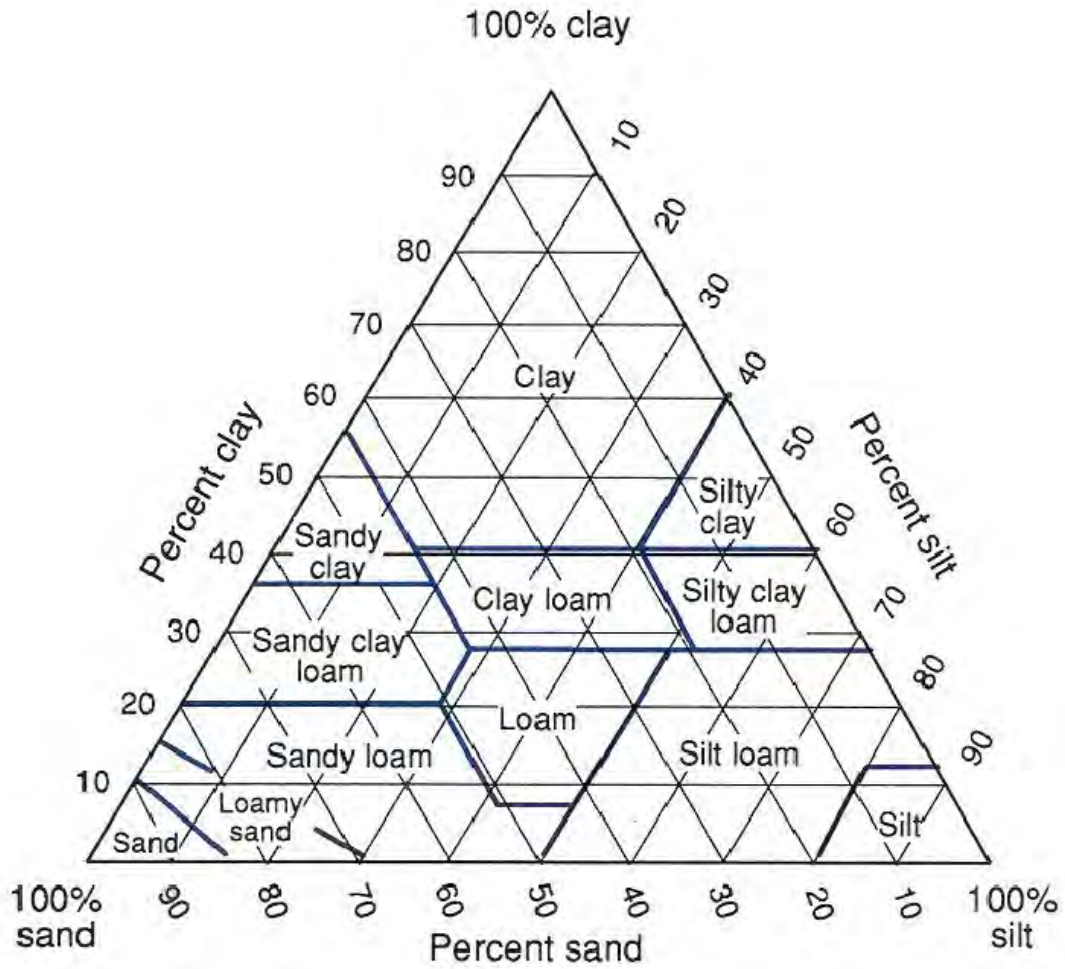
Celebrate Student Success *(Approximately 2 minutes)*

Thank students for their hard work and focus while demonstrating the use of a soil textural triangle. Congratulate students on their ability to determine appropriate soil textural classes as this is important in crop production, landscaping, and even construction. Explain that they will use this information as they determine soil texture and permeability in the land judging competition.

Using Soil Textural Triangle

Guided Notes: Soil Textural Triangle

Notes completed by _____



Soil Textural Triangle How-To Guide:

Using Soil Textural Triangle

Guided Practice: Soil Textural Triangle

Completed by _____

Determine the appropriate soil textural class using the soil textural triangle for each problem below:

1. 40% Sand
50% Silt
10% Clay

2. 70% Sand
15% Silt
15% Clay

3. 35% Sand
15% Silt
50% Clay

4. 20% Sand
60% Silt
20% Clay

5. 30% Sand
40% Silt
30% Clay

7. Which soil textural class do you believe is best for growing plants? Why?

6. Complete the chart using the soil textural triangle.

% Sand	% Silt	% Clay	Texture
5		50	
27	35		
	31	33	
22	23		
10		7	
	7	23	

Using Soil Textural Triangle

Guided Practice: Soil Textural Triangle KEY

Completed by _____

Determine the appropriate soil textural class using the soil textural triangle for each problem below:

1. 40% Sand
50% Silt
10% Clay

Silt Loam

2. 70% Sand
15% Silt
15% Clay

Sandy Loam

3. 35% Sand
15% Silt
50% Clay

Clay

4. 20% Sand
60% Silt
20% Clay

Silt Loam

5. 30% Sand
40% Silt
30% Clay

Clay Loam

7. Which soil textural class do you believe is best for growing plants? Why?

6. Complete the chart using the soil textural triangle.

Answers will vary. Consider there are three general categories of soil texture: coarse texture (sandy soil); medium texture (loamy soil); and fine texture (clay soils). Coarse soil texture soils warm up faster in the spring. Soils with finer textures hold water and nutrients better than coarse textures. Sandy soils usually have good aeration, but can't hold water well. So, both water and nutrients can easily leach through the soils. Clay soils retain more water and nutrients than sand, but there is little infiltration of the water and less oxygen for the plant due to smaller pore space than those of coarser textures. Loam is the ideal soil, holding water, nutrients, and oxygen in a balance of sand, clay and organic matter.

% Sand	% Silt	% Clay	Texture
5	45	50	Silty Clay
27	35	38	Clay Loam
36	31	33	Clay Loam
22	23	55	Clay
10	83	7	Silt
70	7	23	Sandy Clay Loam

Lesson Plan on Soil profiles

Developed by Chantier 7 project team members

Instructional goals: Students will be able to: (1) understand the complex nature of soil (components of different layers, and the creatures living in the soil), and (2) see different types of soil including sandy soil, clay soil, loamy soil.

Grade level: Grade 7, 8

Duration: 50-75 minutes

Instructional Materials:

1. Soil samples from 3 uniquely different sites
2. Garden trowel
3. Extension activity: Erlenmeyer flask, funnel, soil samples

Note: Soil samples will work best if they are collected from a deep source so the organic matter; horizon A, and perhaps horizon B are visible (Garbage bags work best.). Activity must be done in autumn or spring.

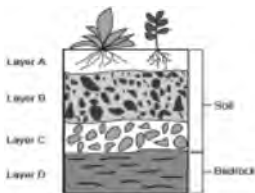
Worksheet: Eureka B, Questions 7, 8, 9 EN 20

QEP POLs for secondary cycle 1 relevant to the concept of soil profiles: Classifies soils based on their composition (e.g. sand, clay, organic material)

Children's preconceptions relevant to the concept of soil profiles: Students often think that soils are uniform in composition, and that all soils are the same (soil is "dirt").

Assessment Items to explore or uncover students' preconceptions around the concept of soil profiles:

Question 1. Below is the diagram of a soil profile. Which layer contains the most organic material (organic materials can be remains of plants and animals and their waste products)?



(<https://creativecommons.org/licenses/by-nc/4.0/deed.en>)

- A. B. C. D.

Question 2. What is true about all soils?

- A. All soils are the same color and texture.
- B. All soils contain weathered rock.
- C. All soils do not contain air.
- D. All of the above.

(Adapted from MOSART, Earth Science Test, Item form #821, Q9)

Description of the Lesson

The following activities have been designed to address students' prevalent alternative frameworks, some of which you might discover by using the two multiple choice items above

Step I of The Lesson: Eliciting Student Thinking/ Intuitive Models

This step involves two activities (i.e., Activity #1 – *Picture the soil!* and Activity #2 – *Activity #2: Think-Pair-Share*), in order to elicit students' prior knowledge and understanding of this topic.

Activity #1: Picture the soil!

- (1) Prepare 1 sample of soil bag and have students observe the bag.
- (2) Tell students a story: *"Hello, we have this bag full of soil today. Now, I want you to imagine that we have a special machine that could magnify a very little spot in this bag of soil, just like what you see on your worksheet."*
- (3) Distribute the worksheet #1 (please see Appendix A) and continue with the story by saying: *"In your worksheet, you see the circle on your worksheet? I want you to draw in the circle what you think you might be able to see in the soil."*
- (4) Allow students to draw on the worksheet. Teacher may circulate the classroom and probe for their explanation. While teachers circulate, try to choose 3-4 students' models that best represent the class's diverse ideas. Teacher can ask the following questions in order to probe for their explanation further:

- *Can you tell me why you draw these?*
- *What happens if it rains?*
- *Do you think what you draw will change or no?"*

(5) Once students complete with drawing, teachers can share the models chosen and have students to explain. For example, teacher can ask: *"Student A, can you please explain what you drew? I see that you draw circles here, what do they represent? Does anyone else have similar pictures than Student A? If so, do you want to add anything else on Student A?"*

(6) After sharing the models, teacher summarizes points that were brought up by students and create a consensus model. Teacher can say: *"Based on your ideas, let's build a class model! Many of you had circles representing soil atoms and different layers of circles. So, do we agree that there are different layers of soil? Many of you also drew worms. Do we want to add worms on our class model?"*

Based on students' response, teacher can add or change class consensus model. Teacher can ask the following questions to guide the discussion:

- Student A said we have different layers in soil, how would you represent this in drawing? Can you come and draw?
- Does everyone agree that we have different layers?
- Does anybody else have different ideas?
- If there are conflicting ideas, try to include both, or turn to class for a vote.

The goal of Activity #1- *Picture the Soil!* is to help teachers to elicit students' diverse ideas before the lesson. In the next Activity #2: *Think-Pair-Share*, students will be invited to make observation of different types of soil. The goal is to further press for students' prior understandings in a deeper level with regards to different types of soil and composition of soil

Activity #2: Think-and-share

This activity allows students to share their prior understanding of the composition of soil with other students in a deeper level. By engaging in observation and argumentation, students have opportunities to explore and explain their ideas. Teacher can probe for students ideas with the guided questions provided in students' worksheet.

In this activity, the students will: (1) **think individually** about the question and write their answer on a paper, (2) **pair with a partner** and discuss their answer and ideas, and (3) **share their ideas with the class**. Students are encouraged to write emerging ideas during the discussion in their Scientist Journal which is used as an evaluation for understanding (If students do not have scientific journal, they can write them down on a piece of paper). Details are described as follow:

(1) Think individually: Collect 3 samples of soil from 3 uniquely different sites. Then introduce today' driving Question: *What happens when you dig deeper and deeper into soil?*

Invite students to observe the bags of soil individually. Here teachers can direct students to touch and feel the different types of soil by saying: *"Here are three different bags of soil. I want you to touch the soil. Look at the colours. I want you to try to answers on your worksheet while you are observing the soils."*

While students are observing different samples of soils, they will also be invited to write their observation on their worksheet (Please see Appendix B). The worksheet includes the following questions:

- What is soil made up of?
- What colours are the soils?
- What stuff can you find in soil?
- Are all soils the same?
- Are soils uniform, or the same as you dig deeper into the soil?

After students fill out the worksheet with answers, the individual responses will be submitted to teachers. The purpose of this step is to help teachers get a sense of students' predominant ideas related to this topic.

(2) Pair with a partner: Ask students to pair with a partner and discuss their answers and ideas. Teachers can circulate the classroom and press for further explanation. For example, teachers can ask: *Do you both think that soils are made up of different rocks? Why? Have you seen soils with different rocks? Why do you think that they are rocks?*

(3) Share their ideas with the class: To engage students in a whole class discussion, teacher can distribute a few sheets of post-it to each team. Ask students to write down their ideas on post-it (answers for the questions on the worksheet)

Have a chart ready on the board (or a chart paper) for each question. With students' responses posted on the board, teachers can start categorize to see the difference and similarities found within students' responses.

Once written down the similarities and differences on the board, teachers can go back to the class consensus model made during Activity #1– *Picture the soil!* to see if students wants to change, add, remove any parts from the class model based on their discussion from Activity #2–*Think-and-share*. Teachers can ask the following question: *"Many of you think that soils are same as*

you dig deeper; how can we represent this idea in our model? Should we colour all soils in the same colour? Are there anyone think that soil changes colours as we dig deeper? If so, do you agree if we add extra colour to our class model? Raise your hands if you agree. Is there anything else we want to change in our class model?"

Note: While working on the class model, please include legends. Also remember to refrain from evaluating students' responses at this point.

Step 2 of the Lesson: Collecting and Making Sense of Data

In order to help students make sense of soil profiles, teacher invites students to dig through the bags of soil from top to bottom. Teacher asks students to describe differences in color, texture, and various components (small stones, organic matter, sand clay). Ask students to write down their observation on the worksheet #1 (please see Appendix A).

Have students examine the texture of the soil by dampening a small handful of soil and rubbing it between fingers. If the soil is sticky, there is a high clay content. If the soil is rough and grainy, there is a lot of sand in the soil. If the soil is neither sticky nor grainy, then the soil is silty (loamy). Teachers can ask the following question: *Do some soils have more pores or spaces in them?*

Create a table (same as the one from the worksheet #1) on a board. Discuss their observations and write students' responses on the board.

Note: teachers can tally. e.g., Colour- brown 5, black 5, mixture of brown and others 6

Have students go through the soil to look for living organisms. Teacher then writes on the board the living organisms found by students, such as small snails, worms, ants, small beetles and other insects.

Step 3 of the Lesson: Developing Evidence-Based Explanations

Ask students to analyze the relationships between soil colour, texture, and living organisms in small groups. Teacher can circulate the room to press for descriptions and observations. Teachers can ask the following questions to guide students to notice patterns.

- What happens when the colours of soil gets darker?
- Are there more living organisms found in the soil?
- Why do you think that is?

Post a summary table of all the groups findings on a chart. Teacher then leads a discussion about the similarities and differences in the group analysis. Teacher can use the following strategies:

Ø **Orienting students to each other's thinking:** For example, teacher can ask: *Do you agree with what Student A said? and Why?*

Ø **Pressing for explanation:** For example, teacher can ask: *Group A and B, both of you said if the colours of soils are darker, there are more living organisms in the soil. Why do you think so?*

Students' discussions might include:

- Soils with a lot of leaf litter and organic matter have more living organisms
- Soils that are rough with a high sand content have many pores, but fewer living organisms.

Step 4 of the Lesson: Extension & Application

Teacher can conduct a follow up activity to further engage students in thinking that soil is made up of distinct layers – horizons – and each layer has its own characteristics that make it different from all of the other layers. The procedures of this activity are as follow:

(1) Fill an Erlenmeyer flask $\frac{2}{3}$ with water. Using a funnel, add soil to the water. (This could be messy).

(2) Shake the Erlenmeyer. Let the soil settle overnight.

(3) The organic matter will stay on top of the water while the heavier particles of sand will sink to the bottom. The layers of silt and clay might be visible resting on top of the sand and gravel.

This activity allows students to understand that the characteristics of each horizon play a very important role in what the soil is used for. For example, the top layer of soil is made up of living and decomposed materials like leaves, plants, and bugs (organic material); this layer is very thin and is usually pretty dark. Under the top layer of soil is the layer made up of minerals and decomposed organic matter and it is also very dark in color; this is the layer that many plants roots grow in. Below the top layers is a layer of soil that has clay and mineral deposits and less organic materials than the layers above it; this layer is also lighter in color than the layers above it. Lastly, the bottom layer of soil is made up of slightly unbroken rock and only a little bit of organic material is found here; plant roots are not found in this layer.

Step 5 of the Lesson: Evaluation

Three strategies can be used to do a post-assessment to examine students' understanding and application of the concepts learned through the activities described above; they are:

(1) **Draw the soil profile:** Have individual students draw coloured soil profiles of the three (which refer to the first activity) soils, including living organisms. All components should be labelled.

(2) **Case study: Which soil is best for an apple tree to grow?**

Give students the following scenario: *Mr. Kim is trying to open an apple farm here in Quebec. He wants to find out in which region in Quebec, his apple tree will grow "better". He hired a group of soil scientists (you and your group) to figure out which regions he should start building his apple farm. You had been given three soil samples; each soil sample is from a different region in Quebec (Soil number 1 from region 1.. and so forth..). Based on your analysis so far, where do you suggest Mr. Kim could open his apple farm?*

Ask students work in groups of 3-4 and try to create a portfolio. Students' portfolio should include the following:

- Soil profiles created from the activities: based on the profile, find out which soil has the most number and diversity of living organisms
- Students should research which type of soil apple tree would "prosper?" the most. (e.g., focusing on texture, colours, living organisms etc.) – Case study....
- A letter to Mr. Kim which include students' suggestion regarding the appropriate soil (#1, 2, 3) and their reasons for the suggested soil type (e.g., evidence from their lab activities- texture, colours, etc.)

(3) **Post-assessment questions:** Administer the same two questions that were given before the lesson to see if students' responses have changed. Teacher can use the clickers to obtain students' responses. If the school does not have clickers, teachers can ask the questions in the class and ask students to raise their hands for their answers. Teachers can also ask students to write their answer on a piece of paper and put them in a box. Teacher will then write some responses on a board (or a chart paper) for discussion.

After administering the test, share the data with students and ask students for the explanations. Sample guiding questions are: We see that many of you choose option C as an answer. Can anybody share why they chose letter C? What is your evidence for saying that?

Note: You may re-voice their explanations and write their response on a board.

This lesson plan is inspired by the following resources:

Eco Kids Corner site: www.cleanair.pima.gov/more/FourLayersSoil.html (<http://www.cleanair.pima.gov/more/FourLayersSoil.html>)

Tran, K.-T., & Escrivá, I. (2008). *Eureka!: Science and technology, secondary cycle one*. Montréal: Graficor Chenelière Éducation.

How Soil is Formed Lesson Plan: Soil Sample Experiments

Submitted by: Mark Wright

Grade Levels: K-3

In this multi-day lesson plan, which is adaptable for grades K-3, students use BrainPOP Jr. resources to explore how soil is formed. Students will also explore some of soil's components through various experiments, books, and online resources, and explain the process of soil formation verbally and in writing using web 2.0 tools.

Lesson Plan Common Core State Standards Alignments

Students will:

1. Explore how soil is formed and some of its components through various experiments, books, and online resources.
2. Explain the process of soil formation verbally in writing using web 2.0 tools.

Materials:

- Soil sample probe
- Large sealable baggies
- Soil samples
- Science journals
- Vocabulary card template from Taksopes.com
- Several books on soil
- Two shallow pans
- Deep pan
- Soil
- Soil with grass growing in it
- Water in a container

Vocabulary:

humus, decompose, topsoil, subsoil, bedrock

Lesson Procedure:

1. **Day 1** Engage the students by taking them outside to different places on the school grounds to see how soil is different and is made up of different material.
2. Have students dig soil from under bushes, under trees, and on open ground and put the soil into large baggies.
3. Allow students to examine the different materials that are in each soil sample to see that soil is a mixture and might have different purposes.
4. Have students log in to their [Grou.ps](#) account (or VoiceThread, Google Docs, blog, wiki, or other online resource) and make a journal entry comparing the different soil samples.

5. Divide students into groups to discuss and answer the following questions about one of the samples taken, and type their answer for submission:
 - What do you notice about the sample?
 - What do you think is in the soil?
 - How do you think the soil is formed?
 - What do you think causes the different colors?
6. **Day 2:** Lead students in a discussion of the components of the soil samples from Day 1.
7. Divide students into groups to try to locate common components in the different samples.
8. While students are examining the samples, have students take turns logging in to BrainPOP Jr.com and watch the [Soil video](#). Afterward, they should take the available quiz and submit the results to the teacher through grou.ps.com (or print them.)
9. Provide books about soil that are appropriate for students' reading levels (such as those on [Pearson Success](#)), and have students complete the comprehension questions at the end of the book.
10. **Day 3:** Discuss the process of soil formation with the class. and show the video "Getting to Know Soil" from [United Streaming](#). While watching, have students notes on the different types of soil and the processes that produce it.
11. Have students generate vocabulary cards in their science journals with their own definitions, pictures, and a sentence with select terms from the video.
12. **Day 4:** Have the class conduct the experiment detailed at [ThinkQuest](#). Students should relate their findings from the experiment on the Grou.ps forum or other online resource.
13. **Day 5:** Have students type a paragraph based on the writing prompts found on Taksopes.com:
 - If you were able to play in a large pile of dirt, or soil, what kind would you like best? Write about handling different soils.
 - Write about why you can do certain things with sandy soil.
 - Describe what you might do if the soil contains lots of plant matter.
 - What if you added water to each of these soils?
14. When students finish the writing, they can access BrainPOP Jr and complete the [Soil Puzzle Game](#) and the [Draw About It](#) activity.

Related:

Filed as: [CCSS.ELA-Literacy.RI.1.1](#), [CCSS.ELA-Literacy.RI.1.3](#), [CCSS.ELA-Literacy.RI.1.7](#), [CCSS.ELA-Literacy.RI.2.1](#), [CCSS.ELA-Literacy.RI.2.3](#), [CCSS.ELA-Literacy.RI.2.7](#), [CCSS.ELA-Literacy.RI.3.1](#), [CCSS.ELA-Literacy.RI.3.3](#), [CCSS.ELA-Literacy.RI.3.7](#), [CCSS.ELA-Literacy.RI.K.1](#)
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Comments



Soil Exploration

Goals

Through garden exploration, students will learn about the properties of soil and why soil is important to plants. They will closely observe soil and practice tallying and reporting results of soil experiments.

Curriculum Alignment

Find a list of which Common Core State Standards and NC Essential Standards this lesson plan aligns with on the lesson plan page at www.growing-minds.org.

Materials

- Soil Sorting worksheet
- Newspaper
- Jars with lids (at least three)
- Water
- Trowels

Activities

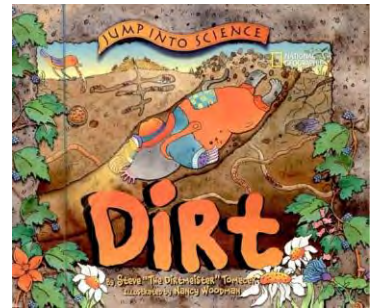
In Class (or In Garden) Discussion

Ask students, "What is soil?" Write some defining words on the board. What do students know about soil? What is it made of? Why is it important? What do students want to know about soil? Optional: Make a KWL chart recording their responses.

Read Dirt by Steve Tomecek. Every page of this book contains valuable information about soil. You can choose to read the entire book to students all at once or break it down into two or three days. Pages 4-15 are especially relevant to the activities in this lesson plan.

Discuss why soil is important for plants (holds water, air, nutrients). What is in soil? Have students think of things that make up soil and then talk about how soils are a combination of sand, silt, clay and organic matter. Soil type, and its capacity to grow plants, is dependent on the mixture of the four components. Review the information in Dirt:

Sand, silt and clay are all different size particles, sand being the biggest (basketball), than silt (baseball), and clay (penny). Have some of each type for students to touch. The way a soil "feels" is called the soil texture. Soil texture depends on the amount of each size of particle in the soil. Sand, silt, and clay are names that describe the size of individual particles in the soil. Sand has the largest particles and they feel "gritty." Silt are medium-sized, and they feel soft, silky or "floury." Clay are the smallest sized particles, and they feel "sticky" and they are hard to squeeze.



Book to Read

Dirt
by Steve Tomecek



Soil Exploration

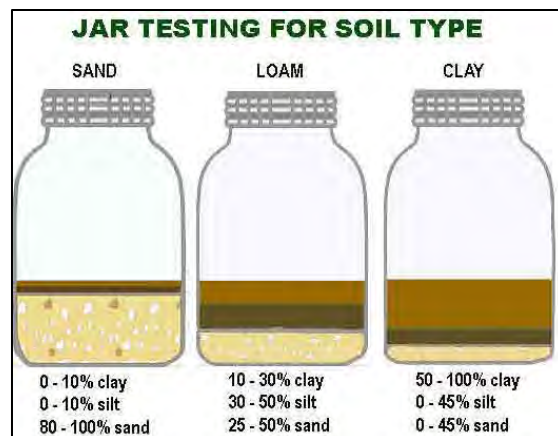
Soil contains much more than just the types of sediment (sand, silt, and clay). It also contains organic matter—like twigs and dead leaves. Organic matter comes from living things such as plants and animals. When organic matter rots or decays, it puts nutrients into the soil that plants need to grow. Farmers and gardeners add organic matter to their soil in the form of compost, manure, leaves, cover crops, and mulch.

Do the Soil Water Dance

Tell students that water moves through each of the different types of soil (sand, silt, clay) differently. Ask the students to stand up. Designate half of the class as “soil” and half as “water.” First, tell soil group that they are sand particles (the biggest type of sediment) and ask them stand very far apart, just like sand particles. Ask the students representing water to move around the “sand.” Was it easy or difficult for them to move around the sand particles? Tell the students that next, they’ll represent clay particles (much smaller). Ask students to stand very close together. The students representing water then try to move through the “clay” particles. How is this different? Review that water moves quickly through sand and that it moves very slowly through clay. At a farm or in the garden water often puddles on top of clay-based soil for many days.

Garden Activity: Soil Shake

Want to find out what types of sediment are in the garden? Guide students in collecting several samples of soil from different locations in the garden, keeping the samples separate. Put each sample in its own glass jar, filling the jar about half way with soil. Add water until the jar is almost full. Put on lid tightly and shake the soil until any clumps are broken down. Leave the jar to settle for several hours. When students return to the jars, they will see distinct layers. Guide students in observing that the different soil particle types – silt, sand and clay –have settled out into their own layers. What types of soil are each soil type composed of? Does one have more sand or more clay? See chart below:





Soil Exploration

Garden Activity: Soil Exploration

Go out to the garden and place students in different areas of the space. Give each student a trowel and a piece of newspaper. Have them dig a small soil sample and put it on their newspaper. Have them examine it and sort it into different groups of things – things that were alive (grass, twig, root), bigger rocks, small rocks, leaves etc. Have students circle and tally the things they found in their soil on the soil sort worksheet. Encourage students to use their sense of touch, sight, and smell to explore the soil. Come back together as a class and select several students to report on their soil sample findings!

Extension

Ask students to sort the soil base on color, hardness, shape, or size. Ask students to bring soil from home and compare them (with one another and with the school garden soil).

Agricultural Literacy Curriculum Matrix

Lesson Plan

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Types by Texture

Grade Levels

3 - 5

Purpose

Students will learn about soil texture and determine the texture of several soil samples.

Estimated Time

1 - 1.5 hours

Materials Needed

Activity 1: Dirt Shake

- Soil samples brought in by students from home, cleaned of rocks, roots, etc. (about 1 cup)
- Quart jars
- Rulers
- Alum (optional)

Activity 2: Soil Textures By Feel

- Soil samples of sand, silt, clay, and local soil
 - A [Soil Sample Kit](#) is available for purchase from [agclassroomstore.com](#) if local samples are not available.
- [Dirt Shake](#) handout
- [Soil Texture Triangle](#) handout
- Small bowls
- Spoons
- Water
- Bucket
- Newspaper

Essential Files (maps, charts, pictures, or documents)

- [Dirt Shake Handout](#)
- [Soil Texture Triangle Handout](#)
- [Soil-Themed Activity Sheets](#)

Vocabulary Words

clay: soil particle less than 0.002 mm.

loam: a mixture of sand, silt, and clay

sand: soil particle that measures between 2.00 and 0.05 mm.

silt: soil particle that is between 0.05 and 0.002 mm.

Did You Know? (Ag Facts)

- Almost all the food you eat, the fiber used to make your clothing, and lumber to build homes is produced by soil.¹
- One shovelful of soil can contain more species of living things than live in the Amazon rain forest above the ground.¹
- 6 billion bacteria species can be found living in a cup of soil.¹
- Farmers use conservation techniques and practices to help maintain fertile soil for planting crops.¹

Background Agricultural Connections

Soil is the foundation of agriculture. Farmers know that different soils are suitable for different crops, but how do they recognize what type of soil they have? Texture is an easily recognizable property that informs farmers about how to manage their soils. Soil texture cannot be changed, and it affects the movement of water and nutrients in the root zone of plants. Clayey soils hold water and nutrients, while sandy soils drain and dry out quickly. Farmers will make different decisions about irrigation, tillage, and what type of crop to plant based on the texture of their soil. With some practice, anyone can learn to recognize

[See More...](#)

Interest Approach - Engagement

1. Start a conversation about soil with your students. Ask the following questions to build interest.
 - What forms of life does soil support? (*plants, bacteria, insects, earthworms, crops*)
 - Name a function of soil that plants depend upon? (*medium for plant growth, transports nutrients & water, anchors roots*)
 - Do all soils look the same, feel the same, and contain the same nutrients? (*no*)
 - How do farmers find out what nutrients are missing in the soil before planting their crops? (*take soil samples and have them analyzed in a laboratory*)
 - What environmental factors play a role in determining soil types? (*mineral material, time of formation, climate, landscape position, organisms*)

Procedures

Activity 1: Dirt Shake

1. Divide the students into groups of three or four. Provide each group with a soil sample or instruct each group to use one of the samples brought from home. **Two notes:**
 - This activity will not work with most potting soil. Soil texture is an evaluation of the mineral component of soil; potting soil is mostly organic matter.
 - Remove rocks, roots, and anything else that is clearly not soil from samples and break up any large clumps before beginning.
2. Provide each group with a quart jar. Instruct the students to place 2" to 4" of soil into the jar, measure the level of soil, and record the measurement as "total soil." It's important to measure and record the depth you start with so that you can accurately estimate the sand, silt, and clay fractions.
3. Add water until the jar is two-thirds to three-fourths full. Add one teaspoon of alum (found on the spice aisle of most grocery stores; it does help the soil settle faster, but is not necessary). Be sure the lid is tight.
4. Shake the jar vigorously until all the particles have been separated by the water, about two minutes. Set the jar down, and allow the soil to settle.
5. After 1 minute, measure the amount of soil on the bottom of the jar. Record this measurement and label it as the "sand fraction." Share the [Dirt Shake](#) and [Soil Texture Triangle](#) handouts with the students.

6. Allow the sample to settle for 3 to 4 hours, then measure again and record the level. This second layer indicates the silt fraction of your soil.
7. The remaining clay particles may take as long as a week to settle depending on the composition of the sample. However, you can use the measurements you already have to determine the amount of clay in the soil. Simply subtract the combined sand and silt measurements from the total soil measurement as shown below. Organic matter will float on the surface of the water. Generally it is a small component that won't affect your measurements, but if there is a floating organic layer large enough to measure, subtract its measurement from the total soil before calculating the clay fraction and before moving on to calculate percentages.
 - Total soil = 2"
 - Sand fraction (first layer) = 1"
 - Silt fraction (second layer) = 1/2"
 - Clay fraction (total soil - sand + silt) = 1/2"
8. Now convert the measurements into percentages as shown here:
 - Sand percentage (sand/total soil x 100) = (1 ÷ 2) x 100 = 50%
 - Silt percentage (silt/total soil x 100) = (1/2 ÷ 2) x 100 = 25%
 - Clay percentage (clay/total soil x 100) = (1/2 ÷ 2) x 100 = 25%



9. Once you know these percentages, use the *Soil Texture Triangle* handout to determine the name of the soil type.
10. Discuss the following questions:
 - Why do the larger particles settle out first?
 - What is the stuff floating in the jar?
 - How does each person's sample compare?

Activity 2: Soil Textures By Feel

1. Place four soil samples of at least three different textural types (sand, silt, clay, and loamy) into four separate bowls. Sample of sand, silt, and clay can be obtained from agclassroomstore.com.
 - **Note:** Samples can be reused if allowed to dry after each use. In each subsequent use, the samples can be moistened to a paste and textured as explained. To show students what the soils look like dry, use a mortar and pestle (a wooden dowel or carriage bolt and plastic bowl will work) to pulverize the sample to its original loose state.
2. Share the *Soil Texture Triangle* handout with students. Show them that there are different names for different types of soil. It will be the task of your students to determine the texture of the supplied soil samples.
3. Explain how the different soil textures feel using the information found near the end of the Background section. Tell the students that they will be determining the texture of each soil sample by feeling it. Explain that each sample is different.
4. Moisten soils to the consistency of "pasty" mud. Do not get them too wet.
5. Divide the class into groups of four. Invite each group, one at a time, back to the table where the soil samples are set up in four bowls on newspaper.
 - **Note:** You may want an activity for students to do independently at their desks while waiting for their turn with the soil samples. Four soil-themed activity sheets are attached for this purpose. The teacher should try to remain with the texturing group as much as possible to guide them through the activity and answer questions.
6. Each student should place about a teaspoon of the "mud" into the palm of his or her hand. Instruct students to rub the soil between their index fingers and thumbs, feeling for the presence of sand, silt, and clay. **Two notes:**
 - Hands must be rinsed between samples to prevent the samples from being contaminated and changing the feel, which will confuse the next students who use the samples.

- To avoid a mess, cover the entire working surface with newspaper and place a bucket of water in the middle of the table for rinsing hands. Have paper towels available. As much of the sample as possible should be returned to the sample bowl before rinsing hands.
7. As they continue to feel the samples, ask students to evaluate how much sand, silt, or clay is present. Students should record their analysis of the soil based on the names provided in the *Soil Texture Triangle*.
 8. After all students have felt and examined the soils, discuss their findings and tell them the actual textures of the samples.
 9. Discuss the following questions:
 - What is the name of a soil that contains a mixture of sand, silt, and clay?
 - How do sand, silt, and clay feel? How can you tell them apart? What are their similarities and differences?

Concept Elaboration and Evaluation

After conducting these activities, review and summarize the following key concepts:

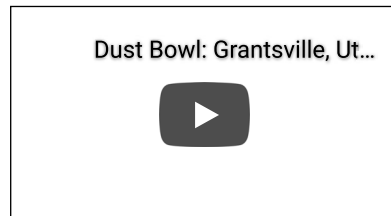
- All soils consist of particles of sand, silt, and/or clay.
- Soil textures can be identified by touch or through a laboratory test.
- Soil texture affects the water holding capacity and nutrient content of soils.
- Farmers identify the texture of their soil and manage it according to the needs of the plants they grow.



We welcome your [feedback](#)! Please take a minute to tell us how to make this lesson better or to give us a few gold stars!

Enriching Activities

- Contact the Cooperative Extension office located in your school's district and invite an agronomist to discuss with your class the soil's nutrient requirements farmers are faced with when planting and growing crops.
- For more activities demonstrating the difference in particle sizes, see the [Soil Texture and Water Percolation](#) lesson plan.
- Connect this lesson to Utah Studies by showing students the 14-minute video [Dust Bowl: Grantsville Utah](#). This short documentary includes interviews from Utah residents who experienced the Grantsville Dust Bowl in the 1930s. Yes, Utah did experience its own dust bowl, but the cause was overgrazing rather than the turn of the plow.



- Play the My American Farm interactive game [Thrive](#).

Sources

1. <http://www.blm.gov/nstc/soil/Kids/index.html>

Suggested Companion Resources

- [And the Good Brown Earth](#)
How can we help? (Soil Texture)



How to Take a Soil Sample

The reliability of a soil test is only as good as the sample you submit. The small amount of soil in the sample bag you send to the Agricultural Testing Lab must represent the entire area to be fertilized. Avoid unusual areas such as those where fertilizer or lime has spilled. Take samples before lime, fertilizer, or manure are added. Use only clean equipment for collecting soil samples.

Where to sample

The area to be sampled should be as uniform as possible in terms of soil type and cropping and fertilizing history. For practical purposes it should be an area you expect to fertilize as a unit. This means separate samples for annual mixed vegetables and a strawberry patch, for golf green and fairway, and for different major crops in a commercial nursery or vegetable operation. If you have a problem on part of a lawn, garden, or commercial production field, you may wish to determine if soil fertility is the cause by taking one sample to represent the “good” and the other to represent the “poor” area.

Take a good sample

Collect a number of cores or slices by walking in a zig-zag pattern over the area. Mix cores thoroughly in a clean pail for a composite lab sample. The greater the number of collected cores mixed together, the better the sample will represent the average condition of the sampled area. Consider 10 cores as the minimum for home gardens and lawns up to 10,000 square feet in size. Larger areas should be represented by at least 15 to 20 samples. Choose one of the following tools:

Soil Probe or Auger – A soil probe or auger, available from mail order catalogs and garden or farm supply outlets, is the best tool for sampling. An auger will be needed if the soil is very stony or gravelly. Simply push the probe (or push and turn the auger) into the soil to the desired depth, lift up to remove the core, and place it in the clean pail. Sampling depth should be 4 to 6 inches deep for lawns, turf, or other perennial sod, or tillage depth (usually 6-10 inches) for annually tilled crops.

Garden Trowel or Shovel – If a soil probe or auger is not available, collect your sample by pushing the blade of a garden trowel, shovel, or spade into the soil to the desired depth. Cut out a triangular wedge of soil and set it aside (to be replaced after sampling). Now slide your blade into the soil again taking a thin (half inch) slice from one side of the hole. With a knife, trim the slice to about a 1-inch strip of soil down the center of the spade – top to bottom. Save this “core” as part of your composite lab sample.

Mix the sample and fill the sample bag

Make sure that all the cores are thoroughly mixed together. Your soil test mailer contains a plastic bag intended for one lab sample. Fill plastic bag about 1/2 full (approximately 1 cup) with the mixed sample. If submitting multiple samples, include one check for total being tested.

Soil Textural Triangle

