

**Study Soil as a Scientist  
(Soil Columns and Chemical Tests)  
Paul Slade**

I. Student knowledge and skills needed to complete the lesson activity.

- Ability to follow written instructions.
- Ability to use chemical test kits
- Ability to measure in Metrics (milliliters and millimeters)
- Ability to work in cooperative groups
- Ability to create a data chart
- Ability to make and record observations
- Gathered local soil for testing

II. Useful websites

- <http://soils.usda.gov> NRCS site with great resources
- MSU extensions for local support
- [www.basic-info-4-organic-fertilizer.com](http://www.basic-info-4-organic-fertilizer.com) Private site with loads of data
- [www.soils.org](http://www.soils.org) private public group with connections
- [www.agiweb.org](http://www.agiweb.org) great resource for teacher and kids
- <http://soils.cals.uidaho.edu> University connection
- [www.youtube.com](http://www.youtube.com) cool videos on soil
- <http://forces.si.edu/soils/video/interactive> Smithsonian Interactive

I. Word Bank/ Key Vocabulary

Soil- Upper layer of the earth where plants grow. Weathered rock with organic materials, air and water.

Humus- decaying plant parts (stems, roots leaves, etc.)

Soil columns- the redistribution on soil in layers after mixed with water 20 times and left to settle in a glass tube.

Soil profile- layers of soil found at location showing soil horizons.

Chemical tester- test kits for Potash, PH, Organic test, Nitrogen

II. Goal of Lesson ( 50 minutes)

The objective of this lesson is to get students to recognize that soil is more than just dirt. The components of soil have different characteristics and these characteristics make soil unique. To scientifically observe and describe soil.

ESE.06.11- How weathering lead to erosion and the formation of soils and sediments

ESE.06.13- Describe how soil is a mixture made up of weathered rock and decomposed organic matter.

ESE.06.14- Compare different soil samples based on particle size and texture

III. Materials and Supplies needed for each group of four to complete the lesson.

DVD resource from NRCS

Student Science Journals or paper

Sample soil of local soil or soil from indoor plant

Sample of store bought soil or any soil

Water

Clear tubes or jars with lids

Hand lens or eyes

Graduated cup or any container

Graduated cylinder or none

Spoons or sporks from cafeteria

Metric rulers or fingers

Plastic Bags

Planters

Seeds

Shovels

Fertilizers

Soil Test kits

Copper Tube

Wood dowel

Mallet

Organic Test solution

Microscope

Color key cards

4 student observation sheets. "Let's Get Dirty" or lined paper

#### IV. Procedures and Instructions

##### **ENGAGE:**

\*\*Here is a Fun fact about soil. In one spoonful on soil there are more bacteria than humans on the earth. Imagine that there are over 4 billion bacteria in a spoonful of soil, what else is in soil?

\*\* Eat fake soil. It is so good for you can eat it.

Questions- What is in soil? Is all soil the same? How does the composition of soils vary?

CHALLENGE the students. Give students about two minutes of think time to write down a few ideas about the questions above. Watch DVD Ten Key messages and Soil Fundamental. Use Accountable Talk to keep everyone together by facilitating a classroom discussion to peak interest and discuss some common knowledge among the class. Record some ideas on chart paper or the ELMO. Leave this up and add new knowledge to it as you go. It can be used to recap later.

##### **EXPLORE:**

After the discussion, propose an experiment we could try to test their skills and ideas by testing some local soils including their schools soil. Each team can tests different things such as PH, mineral content, soil columns, and textures. Each team does not need to complete each test. Get contributions from day-dreamers. Ask a few students about observable differences in soil. Students should gain confidence as they begin to agree on color and texture observations. Verifying and clarifying each others points keeps them accountable to the learning community.

\*\* Has anyone every played in the dirt? Of course (try humor!)

SO LET'S Get Dirty!

Students will work in pairs but will share results as a four person team.

\*\*Post on ELMO and model as you explain the set-up procedures. Ask for any questions and someone to repeat what they need to do to set-up their team. Keep the group together by asking various students to clarify and verify what you are explaining.

#### Roles of team members for Soil Tests

- Getter 1- Gather the tools at station one. (Two tubes, cup, hand lens, graduated cylinder, spoon, shovel and ruler)
- Getter 2- Gather the supplies at station two. (Two soil samples in cups, test kits cup of water)
- Starter- Prepare work area for experiment. Clear books except for science journal and place newspaper on table.
- Reporter- Gather and distribute Soil Column Observation sheets to each team member.

**Purpose:** To investigate how soil columns, soil tests and scientific observation will allow to see how soil samples are different and to describe the differences scientifically so anyone could understand.

**Question:** How does the composition of soils vary?

Follow the procedures listed on the hand-out the best you can. Listen and ask questions as teacher models your procedures and participate in the discussion.

> Students will be recording observations on the handout, reminding them of their measurements and diagrams they need to complete.

\*\* Be sure to ask the group many questions to clarify and keep the channels open for those who are struggling with detailed instructions. Remind them that their team is there to support them and the adults in the room are always there to help. Measurement and drawing samples may be needed depending on the skills and or questions from the group.

During the 50 minute investigation, wander around the room methodically to handle any set-up problems but more importantly to press for accuracy and reasoning while expanding the students reasoning on soil composition. Be mindful of their ideas about why the tubes are settling the way they are such as the mass of particles, size of particles, and type of matter being moved and so on. Clean up fifteen minutes before the end of class. We need time to discuss the results and evaluate their learning.

#### **EXPLAIN:**

Ask the students to keep their data page out to help ideas for the Accountable Talk discussion that will accompany the review of the students' observations. Remember to use your accountable talk and teacher moves to get the most out of this time.

\*\* Would any like to share their soil column diagram and data to the class?

Remind the teams they can share each others ideas.

\*\* Does everyone's look like this? Anyone like to share?

Challenge other students to describe what they see and compare the two examples. Try to pull as many students as possible into contributing to the learning community by asking probing questions and recording important information on the chart you began at the beginning of class. Be sure to

mark important concepts like particle size and compositions of different matter in soil to the students.

\*\* Ask the analysis questions. These could be misconceptions they would like to discuss.

Remind students to record ideas. Use the NRCS disc for details about responses and key concepts the group feels are important. Particle size and mass along with different components of soil (humus/organic material, weathered rock, pebbles, sand, silt and clay) should be enough.

Use the chart paper to recap the learning and to record any unanswered questions that demand further investigation.

**Elaborate/Expand:**

Students could investigate any unanswered questions on their classroom laptops.

Students could get into deeper investigations on chemical tests.

Students could create a team YouTube video using the digital camera.

Students could gather samples from other sites and compare them to their first tests.

Students will plant seeds in two containers. One in the unchanged soil and one in an improved soil or the best soil sample. Keep in the classroom or take home for further discussion and data collection.

**EVALUATE:**

Of course you can evaluate as much as you want but here is what I suggest. An Informal assessment of the group's setup, data collection, and understanding of the concepts should be on-going. Make sure you slow down when needed, model more, and ask rigorous questions as well as simple questions, and reteach key concepts if needed.

Use the enclosed rubric for the data collection/lab worksheet. Try to assess their knowledge and reasoning. Be sure to record these scores in the grade book. Remember to share and display the high level samples of student work. This is a great way to review before moving on to the next lesson.

Assessment Rubric

	4=A	3=B	2=C	1=D
Data collection	Well organized info, detailed measurements, and correct vocabulary	Organized, measurements complete, most science vocabulary correct	Some organization, most measurements, some science vocabulary	Very little organization, some measurements, no scientific vocabulary
Written scientific concepts	Well organized info, detailed descriptions, and correct vocabulary	Organized, complete thoughts, most science vocabulary	Some organization, mostly correct thoughts, some science vocabulary	Very little organization, some correct concepts, no scientific vocabulary
Written Scientific Reasoning	Well organized info, detailed reasoning, and correct vocabulary	Organized, explanations are supported, some science vocabulary	Some organization, explanations are mostly supported, some science vocabulary	Very little organization, some support for explanations, no scientific vocabulary

Try to include anchor papers or samples to show students how to earn each grade. Save examples for next group.

Look for common misconceptions so that you may tackle them in the next session with this ground or deal with during the next group.

V. Hands-on Connection sheets

Use Student Sheet 4.1 during this activity. You may substitute a different sheet like the one below. You could also have each student fill out a Lab Investigation Report Form. (See attached sheet)

SOIL COLUMN OBSERVATION SHEET

1. Describe what happened after you shook up your soil tube?
  
2. How many layers did you observe in the tube after it settled for 5 minutes? Describe what a layer looks like?
  
3. Measure each layer and describe its characteristics.
  
4. Draw a diagram of your "Soil Column". Remember to label as many details as possible.
  
5. Is all soil the same?
  
6. What questions do you still want to investigate?

Let's Get Dirty

Soil Sample	GPS	VEG	texture	structure	color	organic	N	Ph	Po	—	—	Scientific Name
MiTEP	Share-A-Thon									2/16/2011		






Soil Profile	Soil Column

