Groundwork Education in Mathematics and Science

Lesson Planning Guide

Module: Food Chains and Webs **Investigation/Lesson: 1/1 Soil**

Time needed: 1-2 full periods, Sherri Brown & Jafar Hadizadeh (GEMS Mentors)

Content Vocabulary:

weathering
decay
sand
silt
soil
terrarium

Concepts/Skills/Core Content:

What should a student know/be able to do as a result of this lesson?

1. Examine soil samples and be able to identify its components, such as sand, silt, clay, and organic debris
2. Prepare terrarium for study in later activities

Which core content bullet(s) is addressed in this lesson?

2.1.1 . Soils have properties of color, texture, and capacity to retain water and ability to support plant growth.
2.1.2 . The varied materials have different properties which are useful in growing plants we use as food

Materials:

1. Science notebook per student
2. 3 Measuring cups
3. Each group of two:
   - Plastic container for each soil type (i.e. local backyard soil, store topsoil, or potting soil)
   - Hand lens
   - Sheet of white paper (11 in. x 17 in.)
   - Spray bottles
   - Pitcher of tap water
   - Paper Towels
   - Tweezers
   - Plastic wrap to cover white paper (optional)
   - Shallow plastic cup
   - Tablespoon

For terrarium preparation:

- Rye grass seed
- Plastic Container with lid
- Humus
- Gravel
- Masking Tape
- Water

What materials preparation is necessary for this lesson?

Teacher purchases potting soil from local store and retrieves local soil from garden/yard. Soils should be placed in containers with measuring cup access for materials manager to retrieve. Teachers must provide newspaper, water pitcher, water, paper towels, tape, white paper, and a tablespoon.

Classroom/Materials Management:

How will students be grouped?

Groups of 2 for the soil exploration: 1 materials manager and 1 group reporter

How will materials be distributed/returned?

Teacher will distribute paper, towels, cups, and hand lens for exploration. Materials managers will retrieve the various soils and water from the teacher-provided stations. Allow each student to work with the soil to record in science notebook. Both group members will assist with clean-up and return of materials.

Student Notes/Notebooks:

Where and how will students record important classroom information? How will students know what to record?

1) During the soil exploration, students will use science notebooks to record their observations. Entries should include soil component data, plant/animal (once living or living) data, drawings of various soils, soil descriptions, etc. Notebooks will be used instead of the Delta Activity Sheet 1, *Soil*. Notebook entries should provide evidence that the student can identify the soil components (i.e. sand, silt, clay, and organic debris/once living).
2) Prepare a sample science notebook entry on chart paper for the students to model during the exploration (sample attached). Each student should enter observations for 3-4 different soils.
   ** Circulate during this exploration with the checklist (sample attached) to ensure student participation.
3) Each group's recorder will gather group data regarding the types of soil particles present and will provide the group's data to the class Table (sample attached). All students will record the most frequently occurring type of soil particle per soil type in their science notebook.
4) Students will use science notebooks during wrap-up/closure. Class will use a transparency to share-out. After the questioning/discussion period that accompanies the wrap-up/closure, students will enter the BIG IDEAS of the lesson from the content/inquiry flip chart uses to summarize the lesson. Student may underline the key vocabulary terms: weathering, decay, sand, silt, soil, terrarium

How will students organize their notes/notebooks?

Prepare, explain, and model a sample format displayed on a flip-chart for entering soil observation/data during the soil exploration

Guide the closing entries to the science notebook ---the 'line of learning' and the information from the chart that should be entered into each student's notebook

How will you provide feedback to your students about their notes/notebooks and their organization?

Collect notebooks to add comments/suggestions/encouragement. Comments may be provided by using sticky notes that attach to the notebook pages. When students respond to your suggestions, they may remove the sticky notes. Avoid grading grammar, spelling, and punctuation at this time. Notebook entries should provide evidence that the student can identify the soil components (i.e. sand, silt, clay, and organic debris/once living).

Literacy Connections:

The Gift of the Tree (Alvin Tresselt, 1972) – New York: Lothrop, Lee & Shepard
Cactus Hotel (Brenda Guiberson, 1991) - New York: Henry Holt
Once There Was a Tree (Natalie Romanova, 1985) – New York: Dial Books
Chipmunk Song (Joanne Ryder, 1987) – New York: E.P. Dutton
Hide and Seek Fog (Alvin Tresselt, 1987) – New York: Lothrop, Lee & Shepard
A Tree Is Nice (Janice Udry, 1956) – New York: Harper & Row

Fields, S.E. (1993). Life in a teaspoon of soil. *Science Scope, 16*(5), pp 16-18.

Thinking Through the Lesson:

Introduction/Engagement-How will you introduce the lesson and connect it to prior student learning?

Introduction

Teacher will display a soil sample and a rock sample. Teacher will ask students if they know of a process that would allow the rock sample to become the soil sample? Anticipated reply: weathering (connection to students' prior learning). Ask students how long they think it would take for the rock sample to weather into the soil sample. Accept all answers by writing on overhead, chart paper or board. Inform students that geologists have estimated that it takes approximately **12,000** years for rocks to weather into soil. Explain that this time varies with certain conditions, such as parent rock, climate, and landform.

Optional Demonstration: Place small clean rocks into a jar of water, then cover and shake vigorously. The water should turn cloudy as soil particles loosen from the rocks. Ask students to observe the jar carefully and then discuss their observations (NSTA, Dig In! Hands-On Soil Investigations).

Content Connected to Prior Student Learning

Previously students have learned that rocks alter and break down by weathering. The products of weathering include solid and dissolved sediments. The solid products of weathering constitute the bulk of what will become soil: gravel, sand, silt, clay size particles, clay minerals, and iron oxides.

The primary factors in soil formation are:
1. Parent Rock Material (sediment type)
2. Climate (rainfall and temperature)
3. Land Topography/Landform (flat vs. rugged land)
4. Time (rate of soil formation, which is dependent upon all of the above)

The transformation of sediments to soil is gradual and requires cycles of biological activity. The biological activity imparts organic debris (litter), and installs decomposer bacteria and other life forms (e.g. worms, millipedes, ants). This added organic matter is called humus. Thus we could sum up soil formation as:

Solid products of weathering (sediments) + Humus = Soil

Rates of soil formation vary greatly with climate. For example, topsoil in the upper Midwest with typical thickness of 15 inches is 10,000-12,000 years old. This gives a rate of 2-3 inches per 1000 year. Considering that the upper Midwest has a temperate climate (over 50 inches rainfall/year), this suggests that the western U.S. arid climates have soil formation that is extremely slow compared to human lifespan. In comparison, farming and other human activities result in soil erosion and degradation several times the natural rate at which soils are generated.

Facilitation-How will you facilitate learning and move all students to higher order thinking

The previously listed soil formation factors 1 through 4 could be used to promote a deeper understanding of soil.

1. How would a soil formed from a granite parent be different from a soil formed from a limestone parent? Present class with samples of these two rocks and ask them to speculate.
2. Why would soils form much faster in the tropical regions than in the desert areas? How would the roles of animals and plants affect the tropical region.
3. Soils are thinner on hilltops than in the valleys. In the mountains, we rarely see much of soil, but we do see trees that grow out of rock faces. Ask students to comment on these points.
4. Why did it take so long to form 2-3 inches of topsoil in the upper Midwest (Minnesota)? How do we know that soils started to form afresh 10,000-12,000 years ago in the upper Midwest? Glaciation ending 12,000

Closure:

Review the weathering of rocks while emphasizing the products rather than the processes. The closure should revolve around the following points:

1. Rocks ⟶ weathering ⟶ Sediments (gravel, sand, silt, clay, clay minerals, and iron oxides)
2. Humus is added to sediments over a long period of time by animal and plant activity.
3. The type and amount of soil varies depending on the rock type, climate, and landform.
4. Soil is a material necessary for growing plants that produce our food.
5. Upcoming experiments include growing plants in different soil types within a terrarium.

Textbook Resource for Teachers

National Science Teachers Association. (2001). *Dig In! Hands-On Soil Investigations*. Arlington, VA: National Science Teachers Association Press.

http://www.bbc.co.uk/schools/scienceclips/ages/7_8/rocks_soils.shtml

Websites for Teachers

School Gardens
A step-by-step guide to planning, building and maintaining a school garden plus activities, lesson plans and ideas on how you can integrate gardening into every aspect of your curriculum. No room for a garden? No problem, become part of a virtual gardener
http://aggie-horticulture.tamu.edu/kindergarden/Child/school...

What's In Soil
This set of lesson plans allows students to explore the components of soil, make soil, and develop experiments using soil. It is designed for grades 3 to 5.
http://www.sciencenetlinks.com/lessons.cfm?BenchmarkID=4&Doc...

Gradation
These activities will have you exploring the characteristics of soils.
http://www.spacegrant.hawaii.edu/class_acts/GradationDoc.htm...

What is Soil Made Of?
Help your 3-6th grade students understand what soil is made of with this hands-on lesson plan that includes observing, comparing, and contrasting different soils.
http://www.sd5.k12.mt.us/glaciereft/geoso3-8.htm

Soil Science
We walk all over it. We wash it off and let it go down the drain. But we usually don't think much about how valuable it is. What is the stuff we're talking about? It's -- DIRT! Try the following activities and see how great dirt, or soil, really is.
http://www.chemistry.org/portal/a/c/s/1/wondernetdisplay.htm...

Websites for Students

Grow Your Own Garden
Learn everything you need to start your own garden.
http://www.urbanext.uiuc.edu/firstgarden/index.html

An Underground Adventure
Ever wonder what it would be like to live underground? Take a virtual tour of an underground exhibit and see what life would be like if you were a half-inch tall. After your tour, meet a real scientist who will explain the importance of his work.
http://www.fmnh.org/ua/

Soil Types
Soil scientists describe soil types by how much sand, silt, and clay is present.
http://www.urbanext.uiuc.edu/gpe/case2/c2facts2.html

Soil for Gardening Indoors
If you want to grow plants inside, you'll need the information on this page. There are also directions for composting.
http://www.urbanext.uiuc.edu/gpe/case2/c2facts4.html

What is Soil?
Discover the components and qualities of soil.
http://www.urbanext.uiuc.edu/gpe/case2/c2m1.html

Soil Science Education
All about the soil. Learning activities, information, poems, and pictures help to explain this important resource.
http://soil.gsfc.nasa.gov/

Dirt Detective: Trees & Soils Walk
As a dirt detective you'll investigate soil to determine its type and its pH. In the process, you'll learn that different trees prefer specific types of soil.
http://nationalzoo.si.edu/Education/ConservationCentral/walk...

Geology
Why do volcanoes erupt? How are rocks made and destroyed? Why do rivers wiggle back and forth? What sorts of animals roamed the Earth long ago? This page answers those questions and many more.
http://www.windows.ucar.edu/tour/link=/earth/geology/geology...

The Dirt on Soil
Get the dirt on soil at this interactive underground site and learn about soil and some of its tiny but helpful residents. Then board the Earth ship and take a microscopic safari through the soil beneath your feet. e encounter
http://www.school.discovery.com/schooladventures/soil/index....

Why Is Soil So Important?
Join Detective Le Plant as he searches for secrets in soil. Help him uncover the important ingredients in soil that help plants grow.
http://www.urbanext.uiuc.edu/gpe/case2/c2m2.html

What Is in Dirt?
Students will discover that there are many elements to soil. Students will develop their observation and classification skills.
http://sln.fi.edu/fellows/payton/rocks/act/payton2.htm

Soil
Play along with Bernie to get the dirt on soil! See if you can answer his 8 questions and become a soil expert. Also, find out what most people are doing to help save soil and what you can do to help.
http://www.biodiversity911.org/soil/soil_main.html

Soil Safari
This is a journey into the underground world. Microsize yourself to dig into the underground world and meet its tiny but helpful residents
http://www.school.discovery.com/schooladventures/soil/soil_s...

The Dirt on Soil
Explore the many layers of soil by going on this soil safari to test your knowledge.
http://www.school.discovery.com/schooladventures/soil/down_d...

Student Exploration Checklist

Name	3 Soil Descriptions	3 Soil Drawings	3 Soil Particle Tests	3 Soil Snake Tests	Terrarium

Class Summary Table

Group #	Greatest Soil Component (Sand, Silt or Clay)