From Mud Pies to Bricks

Purpose

To introduce the different particle sizes of soils and the properties which each contributes to the soil character

Overview

Students sift soil to remove organic materials and pebbles. They then sift the soil with smaller meshed sieves to separate clay and sand. Students make mud pies by adding water to the various soil components, letting them dry and observing the pie's characteristics. Finally, students create the perfect mud pie or building brick using combinations of soil components.

Student Outcomes

Students will be able to characterize soil.

Students will be able to identify soils based on their particle size distribution.

Students will be able to create building materials from soils.

Science Concepts

Earth and Space Science

- Soil consists of weathered rocks and decomposed organic material.
- Soils are a part of the rock cycle.

Science in Personal and Social Perspective

- Building materials are made from basic resources.

Scientific Inquiry Abilities

- Identify answerable questions.
- Design and conduct an investigation.
- Develop descriptions and explanations using evidence.
- Communicate procedures and explanations.

Time

One class period to sift soils and make mud pies

Overnight to dry

One class period to experiment with creating bricks

Overnight to dry

Level

All

Materials and Tools

- 1 liter soil (loam) for each student group
- Several sizes of mesh screen or sieves for sifting
- Straw (dried grass clippings)
- Additional powdered clay and sand
- Old ice cube trays (for brick molds)
- Small plastic lids or plates (for pies)
- Plastic table cloth

Prerequisites

None

Background

Soil is composed of many different size grains of broken-down rock (sand, silt and clay). How much water a soil will hold, how easily water passes through the soil, and what happens to the soil as it dries depends on the combination of these materials in a particular soil. Soil with too much clay may crack as it dries, as demonstrated by ground with huge cracks or the cracking at the top of a mud puddle when larger, heavier particles have settled to the bottom. Soil with too much sand may not hold together well or be strong enough as a building material.

Soil has been used as a building material for thousands of years, and is still one of our most important building materials. In dry regions houses built of adobe bricks last hundreds of years. Concrete and bricks are common everywhere. Whether you are making concrete or adobe blocks, it is important to understand the importance of having the right elements in your soil mix.

What to Do and How to Do It

Observation

1. Ask students to examine the soil carefully using their eyes, hands, and a magnifying glass.
2. Make a list of the things students observe about the soil. For example: *different size, shape, color of grains,*

other soil materials such as sticks or leaves, 'dustiness', weight, etc.

3. Ask students if they think the soil would be different if all of the particles were alike or if some parts were missing. How would it be different?
4. Starting with the largest mesh sieves, sift the soil.
5. Place what does not go through the sieve in one pile - these are the largest particles.
6. Ask students to examine the 2 piles. How are they alike and different? Can they think of reasons why different size particles would be good for different things?
7. Take the soil that passed through the sieve and sift it through the next smaller mesh.
8. Keep what did not go through the sieve separate, and continue sifting through smaller mesh screens. Students will now have several piles of soil separated by the size of the particles.
9. Ask students to identify words that describe the different piles of soil they now have. Identify the concept of particle size: sand, silt and clay. Words might include: *powdery, rough, smooth, dusty, etc.*

Experimenting

1. Discuss with students the importance of soil as a building material. Ask students to identify things that are built with soil. Example: *concrete sidewalks, brick buildings*
2. Have students describe how they would make a brick using the soil they have.
3. Ask students to describe the characteristics of a good mud pie or brick. For example: *hardness, cracking, resistance to breaking or water, etc.*
4. Ask students to guess which pile of soil would make the best mud pie or brick. Why did they choose the pile of soil that they did? What will happen to each pile when water is added to it?
5. Have students make mud pies or bricks from the soil in each pile by adding water then molding by hand or putting into a mold like an old ice cube tray.
6. Dry completely in the sun or in a warm place.
7. Ask students to test the mud pies or bricks that they made for breaking, cracking, smoothness, etc. List what is good or bad about each one.

More Challenging

1. Challenge students to create the perfect mud pie or brick by combining different amounts of the soil particles they sifted out. Additional sand, clay or organic material may be provided, especially if your original soil did not contain very much of one of these elements. Have students measure or weigh the different ingredients and write a 'recipe' so that they can compare with other students or recreate their creation.
2. Older students can figure the percent weight of each soil component in their recipe.

Further Investigations

1. What happens when the dried bricks get wet? Research how adobe houses are protected from rain.
2. Examine a piece of broken brick. What soil elements can you identify? Why are bricks water resistant?

Assessment

Have students observe soils around their school or at their biology site. Ask how they can determine areas which have more clay or more sand.

Recipe Card	Amount
Ingredients:	
clay (smallest size particles)	
silt (medium size particles)	
sand (large size particles)	
other	
other	