Title: ***Playing in Dirt Is a Good Thing***
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Background Information

The whole objective of a scientist is to develop questions and find possible answers for their surrounding environment. Today's technology (i.e., internet) provides a wealth of information within milliseconds, but sometimes information has to be sought after manually. Sometimes soil scientists, pedologists, and/or wetland scientists must classify soil using the "feel method" (modified by Thien, 1979), which can quickly provide valuable information about the soil's properties. This is essential, especially in the case of an endemic pollution event, because there is a need to know how the soil (and animals within the soil) will be impacted by something like oil contamination. To gauge the best cleaning methods, scientists must know the retention ability of the soils within their study area. The most recent and notable offshore drilling incident was the BP Deepwater Horizon oil spill which was responsible for releasing millions of barrels of oil into the Gulf of Mexico and the surrounding coast. Scientists are still trying to calculate how deep the oil has permeated into wetlands and marshes.

Louisiana State Standards (Grade-Level Expectations)

SI GLE: Generate testable questions about objects, organisms, and events that can be answered through scientific investigations (SI-M-A1)
Describe how investigations can be observation, description, literature survey, classification, or experimentation (SI-H-A2)
Plan and record step-by-step procedures for a valid investigation, select equipment and materials, and identify variables and controls (SI-H-A2)

SI GLE: Select and use appropriate equipment, technology, tools, and metric system units of measurement to make observations (SI-M-A3)
Record observations using methods that complement investigations (e.g., journals, tables, charts) (SI-M-A3)
Use computers and/or calculators to analyze and interpret quantitative data (SI-MA3)
Use technology when appropriate to enhance laboratory investigations and presentations of findings (SI-H-A3)

PS GLE: Measure and record the volume and mass of substances in metric system units (PSM-A1)

Measure and determine the physical quantities of an object or unknown sample using correct prefixes and metric system units (e.g., mass, charge, pressure, volume, temperature, density) (PS-H-A1)

SE GLE: Explain how the use of different energy resources affects the environment and the economy (SE-M-A6)

ES GLE: Relate environmental quality to quality of life (SE-H-C2)

Ocean Literacy Principles

Principle 2d: Sand consists of tiny bits of animals, plants, rocks and minerals. Most beach sand is eroded from land sources and carried to the coast by rivers, but sand is also eroded from coastal sources by surf. Sand is redistributed by waves and coastal currents seasonally.

Principle 6e: Humans affect the ocean in a variety of ways. Laws, regulations and resource management affect what is taken out and put into the ocean. Human development and activity leads to pollution (such as point source, non-point source, and noise pollution) and physical modifications (such as changes to beaches, shores and rivers). In addition, humans have removed most of the large vertebrates from the ocean.

Time Requirement

This is an activity that requires an initial and post setup. Initial setup: Teachers should lay out the "Feel Method" worksheets beforehand to ensure a pre-reading of the steps. Each different soil should be labeled (i.e., numbers) and separated from the next; place a container of water and the weighing device in an open area. The clay and soil can be mixed together for an "alternate soil". Post setup: Pour the oil into the zip lock sandwich bags (teacher or student can complete this). Give 3-5 coffee filters to each group and have a separate area they can place their oiled-soil around the classroom. The initial and post setup should take 5 minutes each.

Materials

3-5 Different soil types (e.g., home improvement stores; peat moss, garden soil, potting soil, lawn soil, cactus/citrus soil, seeding soil, etc.)
Clay and sand (e.g., craft stores; optional) or soil from home (optional)
Gloves (optional)
Water in a container (i.e., faucet)
"Feel Method" worksheet (provided later)
Triple beam balance scale or electronic scale
Calculators (optional)
Vegetable oil

Coffee filters
Zip lock sandwich bags

<u>Lesson Description</u>

Creating the Playing in Dirt Is a Good Thing Activity

1. Allow the students to read the “Feel Method” worksheet prior to the activity.
2. Label each soil by number; tell each group of students (i.e., 2-3 people) they have the option of choosing any soil.
3. Each group should weigh each sample before adding the oil (later on).
4. Instruct them to follow the directions on the “Feel Method” worksheet.
5. Once each group has classified the soil, pour oil into 1/3 of the zip lock sandwich bags and allow them to soak their samples for an hour; it is okay if the groups lightly shake the bags to ensure a well-even coating.
6. Place the oiled-soil samples on the 3-5 coffee filters and let sit overnight.
7. Weigh each sample after the overnight duration (provides enough time for the oil to be soaked into the soil).
8. Calculate the oil retention factor:

    A. Sample weight after oil minus (-) Sample weight before oil.
    B. Divide the difference by the original sample weight (before oil)
    C. The quotient is your retention factor

9. Inform students that everything should be recorded within their notebooks.

Methodology

Students will work in groups to classify an unknown soil type by incorporating the “Feel Method” (modified by Thien, 1979). It is a sequence-type activity in which the sense of touch is used to determine the general type of soil. This approach has been adapted from a previous source, but it is also modified by quantifying the amount of oil contamination, based off of varying retention rates. The main goal of this lesson is to learn how to manually classify a natural product and acknowledge that each soil is different in the amount of liquid it may retain.

Standard Evaluation (Student Deductions)

1. What was your group's sample classified as? If you used a mixture or soil from home, assuming a sand content of 30% and a clay content of 40%, what was the weight of the silt fraction?
2. Define silt, clay, sand, and loam. Which of these are the finest? Which of these are the coarsest? Based on their size, would the different soil particles be transported by water the same way?
3. Why is soil classification important in areas of oil pollution?
4. Which soil (silt, clay, sand, or loam) is the best oil retainer? Which soil is the worst oil retainer?
5. How do these soil types compare to rock or concrete when there is oil contamination? Is there a generalization that can be made about benthic areas (along the seafloor) that are near natural oil seeps?
6. How could oil retention of these soils affect the infauna (aquatic animals that live in the ground)?

The evaluation can be in the form of a test, essay, questions and answers worksheet, or any other mode of measuring retainment or comprehension of material.

Determining Soil Texture by the "Feel Method"

Texture Classification

C	= Coarse
MC	= Moderately Coarse
M	= Medium
F	= Fine

Start

Place approximately one tablespoon of soil in palm. Add water a drop at a time and knead the soil to break down all aggregates. Soil is at the proper consistency when plastic and mobile, like moist putty.

Does soil remain in a ball when squeezed?
- NO → Is the soil to dry?
  - YES → Place approximately one tablespoon of soil in palm…
  - NO → Is the soil too wet?
    - YES → Add dry soil to soak up water. → Place approximately one tablespoon of soil in palm…
    - NO 0 -10% ** → SAND C*
- YES → Place ball of soil between thumb and forefinger, gently pushing the soil with the thumb, working it upward into a ribbon. Form a ribbon of uniform thickness and width. Allow the ribbon to emerge and extend over the forefinger, breaking from its own weight.

Does the soil form a ribbon?
- NO 0 -15% ** → LOAMY SAND C *
- YES → Does the soil make a weak ribbon less than 1" long before breaking?

Does the soil make a weak ribbon less than 1" long before breaking?
- NO → Does the soil make a medium ribbon 1" to 2" long before breaking?
- YES → Excessively wet a small pinch of soil in palm of hand and rub with forefinger.
  - Does the soil feel very gritty? YES 0-20% → Sandy Loam MC
  - NO → Does the soil feel very smooth? YES 0-27% → Silt or Silt/ Loam M
  - NO → Neither grittiness nor smoothness predominates. YES 7-27% → Loam M

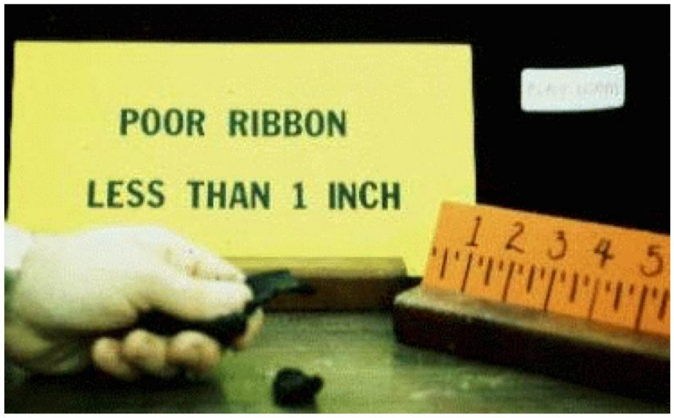
Does the soil make a medium ribbon 1" to 2" long before breaking?
- NO → Does the soil make a strong ribbon 2" or longer before breaking?
- YES → Excessively wet a small pinch of soil in palm of hand and rub with forefinger.
  - Does the soil feel very gritty? YES 20-35% → Sandy Clay Loam MC
  - NO → Does the soil feel very smooth? YES 27-40% → Silty Clay Loam F
  - NO → Neither grittiness nor smoothness predominates YES 27-40% → Clay Loam F

Does the soil make a strong ribbon 2" or longer before breaking?
- YES → Excessively wet a small pinch of soil in palm of hand and rub with forefinger.
  - Does the soil feel very gritty? YES 35-55% → Sandy Clay MC
  - NO → Does the soil feel very smooth? YES 40-60% → Silty Clay F
  - NO → Neither grittiness nor smoothness predominates YES 40-100% → Clay F

* Sand Particle size should be estimated (very fine, fine, medium, coarse) for these textures. Individual grains of very fine sand are not visible without magnification and there is a gritty feeling to a very small sample ground between the teeth. Some fine sand particles may be just visible. Medium sand particles are easily visible. Examples of sand size descriptions where one size is predominant are; very fine sand, fine sandy loam, loamy coarse sand.

** Cay percentage range.

Modified from: Thien, Steven J., Kansas state University, 1979 Jour. Agronomy education.



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