

Mike Keilholz, Pleasant Hill, MO

Ideas Unlimited Region IV NAAE Winner 2018

NARRATIVE: "Soils and Sponges!"

1. Overview

a. Description: I have used "Soils and Sponges" since my early years of teaching in order to find a way to make teaching "soils" more interesting. It gives the students an opportunity to understand surface area and water holding capacities according to soil texture through all the surfaces of a sponge. In addition to surface area retention of water by texture; I also use the sponge to help explain field capacity, gravitational water, capillary water and hygroscopic water. Pore space of an ideal soil and the percentages of air and water can also be visually explained.

(Water Holding Capacity by Soil Texture). I take a sponge and ask the students what has more surface area during the soil texture unit. Sand? Or Clay? Most students will give mixed answers. Once we agree that the clay has more surface area I ask them which texture would "hold the most water". Once we agree that it is the clay, I have them take their sponge and write "CLAY" on the largest flat side of the sponge. Then I have them write "SAND" on the sponge's edge representing the smallest side and then they write "SILT" on the second largest edge side. I have them squeeze and soak the sponge totally full and lay it flat in their hand (palm up) with the "CLAY" side resting on their flat hand. This shows them that the whole flat surface of the clay holds most all the water. Then, I have them turn it to the edge "Silt" side and because of the decreased surface area; a large portion of the water drains from the sponge. Then I tell them that we agreed that the "Sand" side had the least surface area and have them turn it to the end side and even more water would fall from the sponge. Quickly, I have them turn it back to the "CLAY" side and the water stops dripping because the clay side had more surface area to hold the water and prevent it from falling. With that in mind; I have them take a cup and slowly pour more water on to the sponge and it shows them that it will hold it until it reaches a term called "Field Capacity". Then repeat concept.

(Field Capacity, Gravitational, Capillary and Hygroscopic Water). With the same sponge, I have the students bring the sponge back to "Field Capacity" by squeezing and slowing allowing the sponge to absorb as much water as possible. At this point, they have the sponge in their flat in their hand (palm up) and tell them that this is called "Field Capacity". The "soil" is at maximum water holding capabilities and any additional water that they add will drop out the same amount. I have them add 4-6 drops of water to their sponge and then they see that 4-6 drops come from their sponge. That's the teaching moment when I call that water "Gravitational" water and that gravity is the factor. Then I can further discuss how and why "Run-off" occurs in soils as well. This free water is discussed to see if that water is available for plants to use or not. After that discussion; I have them squeeze out the sponge to show them that is "Capillary" water and how this is available for plant/plant roots to use. To sum it up, I discuss factors of when a plant lacks water in the soil and it gets to the wilting stage. At this stage, water up-take cannot keep up with the transpiration rate even though there still is some moisture in the soil; but it is held so tight by the soil molecules that it is unavailable for plant growth. Next, I'll have students

really squeeze and ring out the sponge as tight as they can and have them place it on their bare arm or to another student to see if the sponge still feels damp. (It will.) That's when I tell them that the water left in the sponge (that which they can't squeeze out any more) is "Hygroscopic" water.

(Pore Space) We discuss that the ideal soil has 5% organic matter, 45% mineral matter, 25% water and 25% air. It is easy to teach this concept by showing the students that the sponge's pores are much like that of a soil. I can show them that of the "Pore Space" percentages change by adding water and that as it absorbs more water, the air pore space is replaced by water, thus reducing air space.

(Capillary Action of Water) I have students put the small edge of a sponge in a small amount of water. They watch the sponge take up water to illustrate the capillary action of the water in a soil and I can discuss watering techniques with them. We use different sponges with larger pores to show the differences soil texture can make in how far up the water gets absorbed and can also discuss how a perk test works.

b. How it is Unique: Students are handed a small sponge, permanent marker and small pan of water. They will get a chance to do the very concept as the teacher first demonstrates. It is a great way to use the multi-sensory learning and learn by doing.

c. Fresh and Novel in Agricultural Education : Even though I have utilized this motivational device when I developed this idea early in my career; it really didn't dawn on me how many other teachers were struggling with keeping soil units exciting and entertaining. I had the privilege of having my own two daughters in a Horticulture class and when I introduced the unit of soils; my oldest daughter whispered, "Who are you and where did you come up with this?" in a very positive manner. When I saw them repeat these ideas and heard them talk the vocabulary, I knew that this concept needed to be shared. A couple months later, I was teaching a college class as an adjunct instructor for a pasture management class and was amazed by their response.

2. Practicality of Idea

a. Widespread Appeal: This idea can be used in any soils,