Color	Descriptor
	Lesson Information
	NGSS
	PBE
	Unit Connections
	ELL
	The teacher Information
	Suggested Procedure

Lesson 4: The Dirt on Soil in the Sagebrush

Unit: 5th Grade Ecology Unit: A Sagebrush Expedition
Lesson: The Dirt on Soil in the Sagebrush

Overview: This lesson aims to have students dig deeper into soil. Although plants rely chiefly on air and water to grow, which they learned in the previous lesson, soil is extremely important for plants as it provides stability, nutrients, and hold water. Students will be given the opportunity to learn about how a local research scientist uses soil to predict the future of the sagebrush ecosystem as they learn how to test and take samples of the soil. They will learn about the different particle sizes in the soil and how this affects water retention, different layers that can be found in soil, and test the pH. They will then be asked to apply this knowledge to continue the story of their local, sagebrush landscape as they work to gain a better understanding of this ecosystem.

Main Take Away: Students will learn the importance of how soil provides stability, nutrients, and holds water for plants. They will focus on how a local research scientist uses soil to predict the future of the sagebrush ecosystem as they learn a variety of methods of how to test and take samples of the soil.

Learner Outcomes

Students will be able to…

- Explain and identify the three particle sizes found in soil (sand, silt, and clay).
- Practice various scientific skills through sampling and testing soil to gain a better understanding of the role soil plays in the landscape.
- Begin to understand how soil type and water availability in the soil can help determine future land management practices through a local Wyoming scientist's research.

Getting Ready

Materials: plastic bottles, sand, silt and clay samples, water, soil, soil cores, pH kits, example recording sheet, soil horizon diagram, naturalist journals, pencil, and Dr. Kyle Palmquist's video.

Preparation: Cue video to be shown in the classroom. Beforehand, gather plastic bottles, sand, silt and clay samples, soil cores, soil core sample from different location, soil sample for students to look at, and pH kits. Print out several soil horizon diagrams and example recording sheet. Having soil samples from another location will allow students the opportunity to compare and contrast with soil they sample near school.

Location: Classroom and outside of school. Tests can be repeated on field trip days.

Length of Time:
1-2 Lessons
Approximately 60-75 minutes
Sample skills and tests can be repeated on field trips

NGSS Standard(s) Addressed: 5th grade Life Science 1: From Molecules to organisms: Structures and Processes

- **Science and Engineering Practices: 5-LS1-1:** Engaging in argument from evidence: support an argument with evidence, data, or a model.
- **Connections to Nature of Science: 5-LS2-1:** Scientific knowledge is based on empirical evidence

Place-Based Principle(s) Addressed:

- Using local experts
- Learning takes place in the school yard, local community, and local environment.
- Engaging students in inquiry and experiential learning.

Unit Connections
(How specific lesson connects to overall goals and objectives of the unit)

Transfer Goals: ***Students will be able to independently use their learning to understand that…***

- TG1- Science is a process that helps us gain a collective understanding of how the world works, it is a lifelong process, it is applicable every day, and accessible to everyone.
- TG2- Humans are an interconnected part of the natural world and can have both positive and negative impacts.
- TG3- Cultivating a sense of place, through intentional interactions, inspires curiosity about one's community and helps to develop a conservation ethic.

Unit Essential Question: ***Students will keep considering…***
What is special about my community and what can I learn from it?

Specific Lesson Content Objectives: ***students will understand and be able to…***

- Explain and identify the three types of soil particles.
- Acquire various skills of testing and sampling soil to gain an overall better understanding of a particular soil and how it plays a role in the overall landscape.
- How soil and water availability in the soil can help determine future land management practices through a local Wyoming scientist's research.
- Engage in scientific investigations that allow students to support an argument with evidence, data, or a model.

Specific Lesson Language Objectives: ***Students will be able to…***	**Key Vocabulary Words:**
• Students will be able to name and describe the three particle sizes of soil (sand, silt and clay).	• Soil • Evidence • Argument • Soil particles (sand, silt, clay)

Background Information for the teacher:

Dirt versus Soil:

Dirt is what you find under your fingernails. Soil is what you find under your feet. Think of soil as a thin living skin that covers the land. It goes down into the ground just a short way. Even the most fertile topsoil is only a foot or so deep. Soil is more than rock particles. It includes all the living things and the materials they make or change.

Soil: A natural body comprised of solids (minerals and organic matter), liquid, and gases that occurs on the land surface, occupies space, and is characterized by one or both of the following: horizons, or layers, that are distinguishable from the initial material as a result of additions, losses, transfers, and transformations of energy and matter or the ability to support rooted plants in a natural environment.

The lower boundary that separates soil from the non-soil underneath is most difficult to define. Soil consists of horizons near the Earth's surface that, in contrast to the underlying parent material, have been altered by the interactions of climate, relief, and living organisms over time.

Commonly, soil grades at its lower boundary to hard rock or to earthy materials virtually devoid of animals, roots, or other marks of biological activity. For purposes of classification, the lower boundary of soil is arbitrarily set at 200 cm.

Ground level: Plants grow and animals live here. Decomposers recycle dead plants and animals into humus.

Topsoil: This sometimes called the organic layer. A thick cover of plants can keep the soil cool and keep it from drying out. Decomposers recycle dead plants and animals into humus.

Subsoil: This is a mix of mineral particles and some humus near the top. Subsoil is very low in organic matter compared to the topsoil. This is the layer where most of the soil's nutrients are found. Deep plant roots come here looking for water. Clays and minerals released up above often accumulates here as water drains down.

Weathered parent material: This horizon can be very deep. There's no organic matter here at all. It's all rock particles, full of minerals. The entire soil profile used to look like this all the way to the surface. Physical weathering broke the parent material up into small pieces. This layer may contain rock particles that are different from the bedrock below. A river or a glacier might have brought it from somewhere else.

Bedrock: The bedrock formed before the soil above it. It will wait here until erosion or an earthquake exposes it to the surface. Then some of it will be weathered to become the next batch of parent material. The soil-making process will the start all over again.

Soil Forming Factors

Parent material. Few soils weather directly from the underlying rocks. These “residual” soils have the same general chemistry as the original rocks. More commonly, soils form in materials that have moved in from elsewhere. Materials may have moved many miles or only a few feet. One example is glacial till. This is a material ground up and moved by a glacier. The material in which soils form is called “parent material.” In the lower part of the soils, these materials may be relatively unchanged from when they were deposited by moving water, ice, or wind.

Sediments along rivers have different textures, depending on whether the stream moves quickly or slowly. Fast-moving water leaves gravel, rocks, and sand. Slow-moving water and lakes leave fine textured material (clay and silt) when sediments in the water settle out.

Climate. Soils vary depending on the climate. Temperature and moisture amounts cause different patterns of weathering and leaching. Wind redistributes sand and other particles especially in arid regions. The amount, intensity, timing, and kind of precipitation influence soil formation. Seasonal and daily changes in temperature affect moisture effectiveness, biological activity, rates of chemical reactions, and kinds of vegetation.

Topography. Slope and aspect affect the moisture and temperature of soil. Steep slopes facing the sun are warmer, just like the south-facing side of a house. Steep soils may be eroded and lose their topsoil as they form. Thus, they may be thinner than the more nearly level soils that receive deposits from areas upslope. Deeper, darker colored soils may be expected on the bottom land.

Biological factors. Plants, animals, micro-organisms, and humans affect soil formation. Animals and micro-organisms mix soils and form burrows and pores. Plant roots open channels in the soils. Different types of roots have different effects on soils. Grass roots are “fibrous” near the soil surface and easily decompose, adding organic matter. Taproots open pathways through dense layers. Micro-organisms affect chemical exchanges between roots and soil. Humans can mix the soil so extensively that the soil material is again considered parent material.

The native vegetation depends on climate, topography, and biological factors plus many soil factors such as soil density, depth, chemistry, temperature, and moisture. Leaves from plants fall to the surface and decompose on the soil. Organisms decompose these leaves and mix them with the upper part of the soil. Trees and shrubs have large roots that may grow to considerable depths.

Time. Time for all these factors to interact with the soil is also a factor. Over time, soils exhibit features that reflect the other forming factors. Soil formation processes are continuous. Recently deposited material, such as the deposition from a flood, exhibits no features from soil development activities. The previous soil surface and underlying horizons become buried. The time clock resets for these soils. Terraces above the active floodplain, while genetically similar to the floodplain, are older land surfaces and exhibit more development features.

These soil forming factors continue to affect soils even on “stable” landscapes. Materials are deposited on their surface, and materials are blown or washed away from the surface. Additions, removals, and alterations are slow or rapid, depending on climate, landscape position, and biological activity.

When mapping soils, a soil scientist looks for areas with similar soil-forming factors to find similar soils. The colors, texture, structure, and other properties are described. Soils with the same kind of properties are given taxonomic names. A common soil in the Midwest reflects the temperate, humid climate and native prairie vegetation with a thick, nearly black surface layer. This layer is high in organic matter from decomposing grass. It is called a “mollic epipedon.” It is one of several types of surface horizons that we call “epipedons.” Soils in the desert commonly have an “ochric” epipedon that is light colored and low in organic matter. Subsurface horizons also are used in soil classification. Many forested areas have a subsurface horizon with an accumulation of clay called an “argillic” horizon.

Soil Layers:

O Horizon: The top, organic layer of soil, made up mostly of leaf litter and humus (decomposed organic matter).

A Horizon: The layer called topsoil; it is found below the O horizon and above the E Horizon. Seeds germinate and plant roots grow in this dark-colored layer. It is made up of humus (decomposed organic matter) mixed with mineral particles.

E Horizon: The eluviation (leaching) layer is light in color; this layer is beneath the A Horizon and above the B Horizon. It is made up mostly of sand and silt, having lost most of its minerals and clay as water drips through the soil (in the process of eluviation)

B Horizon: Also called the subsoil; this layer is beneath the E Horizon and above the C Horizon. It contains clay and mineral deposits (like iron, aluminum oxides, and calcium carbonate) that I receive from layers above it when mineralized water drips from the soil above.

C Horizon: Also called regolith: the layer beneath the B Horizon and above the R Horizon. It consists of slightly broken-up bedrock. Plant roots do not penetrate into this layer; very little organic material is found in this layer.

R Horizon: The un-weathered rock (bedrock) layer that is beneath all the other layers.

Measuring Soil pH

Soil pH provides various clues about soil properties and is easily determined. The most accurate method of determining soil pH is by a pH meter. A second method which is simple and easy but less accurate then using a pH meter, consists of using certain indicators or dyes.

Many dyes change color with an increase or decrease of pH making it possible to estimate soil pH. In making a pH determination on soil, the sample is saturated with the dye for a few minutes and the color observed. This method is accurate enough for most purposes. Kits (pH) containing the necessary chemicals and color charts are available from garden stores.

There may be considerable variation in the soil pH from one spot in a field or lawn to another. To determine the average soil pH of a field or lawn it is necessary to collect soil from several locations and combine into one sample.

Descriptive terms commonly associated with certain ranges in soil pH are:

- **Extremely acid:** < than 4.5; lemon=2.5; vinegar=3.0; stomach acid=2.0; soda=2–4
- **Very strongly acid:** 4.5–5.0; beer=4.5–5.0; tomatoes=4.5
- **Strongly acid:** 5.1–5.5; carrots=5.0; asparagus=5.5; boric acid=5.2; cabbage=5.3
- **Moderately acid:** 5.6–6.0; potatoes=5.6
- **Slightly acid:** 6.1–6.5; salmon=6.2; cow's milk=6.5
- **Neutral:** 6.6–7.3; saliva=6.6–7.3; blood=7.3; shrimp=7.0
- **Slightly alkaline:** 7.4–7.8; eggs=7.6–7.8
- **Moderately alkaline:** 7.9–8.4; sea water=8.2; sodium bicarbonate=8.4
- **Strongly alkaline:** 8.5–9.0; borax=9.0
- **Very strongly alkaline:** > than 9.1; milk of magnesia=10.5, ammonia=11.1; calcium oxide or calcium hydroxide=12

pH Affects Nutrients, Minerals and Growth

The effect of soil pH is great on the solubility of minerals or nutrients. Fourteen of the seventeen essential plant nutrients are obtained from the soil. Before a nutrient can be used by plants it must be dissolved in the soil solution. Most minerals and nutrients are more soluble or available in acid soils than in neutral or slightly alkaline soils.

Phosphorus is never readily soluble in the soil but is most available in soil with a pH range centered on 6.5. Extremely and strongly acid soils (pH 4.0-5.0) can have high concentrations of soluble aluminum, iron and manganese which may be toxic to the growth of some plants. A pH range of approximately 6 to 7 promotes availability of plant nutrients.

But some plants, such as azaleas, rhododendrons, blueberries, white potatoes and conifer trees, tolerate strong acid soils and grow well. Also, some plants do well only in slightly acid to moderately alkaline soils. However, a slightly alkaline (pH 7.4-7.8) or higher pH soil can cause a problem with the availability of iron to pin oak and a few other trees in Central New York causing chlorosis of the leaves which will put the tree under stress leading to tree decline and eventual mortality.

The soil pH can also influence plant growth by its effect on activity of beneficial microorganisms Bacteria that decompose soil organic matter are hindered in strong acid soils. This prevents organic matter from breaking down, resulting in an accumulation of organic matter and the tie up of nutrients, particularly nitrogen, that are held in the organic matter.

Building Background for Students: (ELL principle)

Activate Prior Experiences:

The teacher will have students to the following:

1. Recall what they learned about what plants chiefly need to grow.

2. Think about and then share their thoughts with the other students at their tables.
3. Students will share out what plants need to make their own food.
4. Remember that plants do not make their food from soil, but do receive nutrients from soil.
5. Explain that students will be exploring the importance of soil in the sagebrush ecosystem. Each table will have different soil types on it.
6. Make observations about each example by drawing and writing descriptive words in their naturalist journals and can work together on this activity.
7. Recall what observation means.
8. Act out kinesthetic movement they invented from the prior class.
9. Share their observations with the class and descriptive words can be written on the board.
10. Engage in a mini investigation to time how long it takes different soil samples to filter through water. Explain that this will help them learn about which soil holds water better and which soil type lets water pass through quickly. Students will work in small groups to perform this task.
11. Finally, students will discuss why one soil type lets water filter through more quickly than the other one.
12. Share their thoughts with the class.
13. Discuss the different particle sizes that can be found in soil, sand, silt and clay. Students will discover that sand is the largest particle size which is why water filters through it the fastest and clay is the smallest particle size.

Link to New Learning from Prior Learning:
The teacher will ask students to do the following:
1. Students will go outside and dig up a soil sample near their school. They will be taught how to perform a ribbon test, where they can observe whether or not the soil sticks together.
2. Ask students, "What type of soil particles are present if the soil sample sticks together really well?"
3. Students will think back to the previous investigation to come up with an answer.
4. Discuss their thoughts in pairs and share with the whole group. Students will understand how long it takes this soil sample to filter through water and compare it to the previous soil samples.
5. Make connections and think about whether the soil they dug up outside their school would hold or retain water or let it filter through quickly.

Vocabulary:
The teacher will ask the students to do the following:
1. Draw the three soil particle sizes in their naturalist journals.
2. Label each drawing as either sand, silt or clay. These three words can be added to the word wall.
3. Give a descriptive word and drawing to be placed with the word on the word wall.

Common Student Misconceptions/Student Challenges:
- Soil is uniform throughout all the layer
- Soil provides food for plants to grow.

Materials:	Set-up:
• Plastic bottles • Sand, silt and clay samples • Water • Soil samples from other location • Soil cores • pH kits • Example recording sheet • Soil horizon diagram • Naturalist journals and pencil • Dr. Kyle Palmquist's video	• Cue video to be shown in the classroom • Beforehand, gather plastic bottles, sand, silt and clay samples, soil cores, soil core sample from different location, soil sample for students to look at, and pH kits • Print out several soil horizon diagrams and example recording sheet • Having soil samples from another location will allow students the opportunity to compare and contrast with soil they sample near school.

Lesson Agenda	Suggested Procedure	Rationale

Review: Approximately 10min
 	
Engage: Approximately 15min
 	
Students will be introduced to the different particles of soil through observations
 	
Students will make connections through learning from a local scientist
	Bean Seed Mini SCI:
	• Let students have a few minutes to take a look at their bean seed investigations and record whether or not they have sprouted.
	Review:
	• Give me Five:
	  ○ Pose the following:
	    ▪ "What is an abiotic factor and how does it play a role in the sagebrush landscape?"
	    ▪ Inform students to have a moment to think individually and then you will pick five to share their thoughts.
	    ▪ Students can give an example of something that is abiotic as their response. **(D1)**
	Introduce Soil:
	• Pass out containers filled with soil to small groups of students.
	• Give students a few moments to make observations. Encourage students to make observations based on the following: what the soil looks like, what it smells like, and what it feels like.
	• Ask 3-5 students to share their observations. If other students agree with this observation ask them to give a thumbs up, if students disagree with this observation have them give a thumbs down, and if they did not notice this have them give a fist.
	  ○ Ask students who gave a thumbs down to provide reasoning.
	University of Wyoming Research Scientist Video:
	• Explain to students that many research scientists look at soil in order to gain a better understanding of a particular landscape, such as the sagebrush landscape.
	• Pose following question: "What is soil and how can soil help us understand more about a landscape?" Have students think about this and share one idea with a partner. **(D2)**
	  ○ *Potential student responses:*
	    ▪ *Soil is tiny pieces of broken up rock.*
	    ▪ *Soil is used in gardens and is dark colored.*
	    ▪ *Soil determines what type of plants might grow in that landscape.*
	    ▪ *Specific animals might need soil to build their homes.*
	    ▪ *Different types of soil can hold different amounts of water which plants need to grow.*
	• Students will be watching a short video about a research scientist from the University of Wyoming. The research looks at how changes in temperatures, precipitation type, and amount of snowpack over time can affect the water availability in the soil, which then influences plants such as sagebrush.
	• Watch Dr. Kyle Palmquist's video
	  ○ Ask students if they have any questions about what was
		• Review is a strategy used to increase comprehensibility by giving students the opportunity to summarize and repeat what they learned previously.
		• Hands-on inquiry-based instruction increases comprehensibility by creating a common experience for all students.
		• Placing vocabulary in context helps with new vocabulary.
		• Working in small groups' increases interaction through exploring together and sharing observations.
		• Watching a short film will increase comprehensibility by providing a visual of a local scientist's research.
		• Questions about soil will activate

	said in the video, including any vocabulary words not understood. o Explain that learning about the properties soil and how different soil types can determine the type of vegetation that can grow in a particular landscape. o Explain that they will be learning more about soil through various activities and investigations. o Inform students that research scientists do this type of investigation to better understand the soil they are working in and provides information about the type of vegetation expected to be found in this landscape.	prior knowledge.
Explore: Approximately 20-30 min each activity Physical properties could be explored one day and chemical properties another **Students will be introduced to a variety of scientific methods to study soil. They will look at both the physical and chemical properties**	**Soil Particle Size Demonstration:** • Students will be introduced to the three particle sizes that can be found in soil, (Sand, silt, and clay). • Divide students into small groups and give each group a small sample of sand, silt, and clay. • Have students make observations about sizes of the three soil particle types. • Students will write and draw their observations to create a model of soil particle sizes in their naturalist journals. **(F1)** • Pose the following: "Using what you know already and your observations, hypothesize which soil type would be better for holding water and which one would allow water to pass through quickly." o *Potential student responses:* ▪ *The sand will let water through the fastest.* ▪ *The sand will hold the most water because there is a lot of sand in the ocean.* ▪ *The silt and clay will get muddy which means they are holding more water.* • In their small groups, students will be given two plastic bottles filled with water. o Students will add sand to one water bottle and time (using a stopwatch or having one partner count) how long it takes for the sand particles to sink to the bottom. o Then they will add the silt and clay to the second water bottle and time how long it takes these particles to sink to the bottom. o Students will record this data in their naturalist journals. • Based on their results, students need to draw a conclusion about which soil particle size would be best for holding or retaining water and which one would allow water to pass through quickly. o Students need to record this in naturalist journals through words or drawings and mention if these results support their hypothesis. • Have each small group share their findings with another group. o If there were different results between the two groups, ask students to discuss why they think this might have	• Hands-on explorations increase both interaction and comprehensibility by creating a common experience for all students and provide context for new concepts and vocabulary. • These hands-on, inquiry-based explorations will also help to link prior knowledge to new learning about soil through practicing and engaging in a variety of scientific methods. • Drawing conclusions, explaining, and comparing will help increase higher order

	occurred.
	Soil Layers Test:
	• Explain that another way scientists understand soil is by taking a soil profile. The researcher collects information about the compositions and properties of the soil as they dig down. *(Refer to The teacher background above for information on the different horizons that exist)*
	• Have students go outside to practice taking a soil layer sample.
	• Students will work together with soil cores to take a sample of the soil layers to see which horizons exist outside of their school.
	• Instructor will demonstrate how to properly and safely use the soil core and will point out the horizons or layers that are present in this sample.
	    o Ask students what differences or similarities they notice throughout the soil sample.
	• Using the soil horizon handout (*provided at the end of this lesson*) students will determine which layers are present in this sample. Emphasize the importance of O Horizon.
	    o Pose the following question, encouraging students to study the horizon diagram: "Why is the O horizon important for plants?"
	    o *Potential student's responses:*
	        ▪ The organic matter in this layer provides nutrients plants need.
	        ▪ Plants roots can't reach lower layers.
	        ▪ The bedrock layer is solid and would not let roots pass.
	• Students will take a soil sample using the soil core.
	    o Students will be asked to share their findings with another group and compare and contrast the layers or horizons they notice.
	    o Groups will discuss what grows in the soil and indicate what plants are growing. Ask students to think about the following:
	        ▪ Are there trees growing?
	        ▪ Are there many different types of plants or only one type?
	• Ideally, students should perform this scientific test in several locations so students can compare and contrast the different samples. It would work well to take a few samples at the school and then take a few samples on the sagebrush field trip. The instructor can also bring in a sample from a different location.
	• Before moving on to the next activity, ask Students, "How does this test help us, as research scientists, to better explain this landscape?"
	    o *Potential student responses:*
	        ▪ *The amount of organic material will help explain*
		thinking through comprehension, analysis, and evaluation.
		• Working in small groups and pairs will increase interaction.
		• Think-pair-shares of findings will increase interaction.
		• Lower level ELLs will demonstrate understanding through drawings, participation and pointing to soil types based on oral instructions.

what types of plant would be able to grow in this landscape.

If the soil layer is shallow, trees will have a hard time growing because their roots cannot penetrate the bedrock layers.

Soil Ribbon Test:

- The next scientific test will give the students the opportunity to apply what they have learned about soil particle size, water retention, and soil layers.
- Outside, students will be asked to perform a soil ribbon test. This is a test done by scientists to get a better idea of the composition of the soil to determine how much water it can hold. *(This can be done with any soil outside the school as well as on a field trip to the sagebrush)*
- Each student will be asked to collect a soil sample about the size of a ping pong ball.
    - Using magnifying glasses, they can take a closer look at the soil and share these observations with an elbow buddy.
        - Ask students to explain what the soil looks like, smells like, and feels like.
        - Ask students:
        - "Can you see any individual particles or grains?"
        - "What color is the soil?"
        - "What differences and/or similarities can you detect in this sample versus the sample you took with soil core?"
- Students will add a small amount of water to their soil sample to test whether or not the soil particles stick together.
    - If they do stick together they should be able to form a ribbon-like form using their pointer finger, middle finger, and thumb.
    - Pose the following: "What does this test indicate about the composition or particle size of your soil sample?"
        - *Potential student responses:*
            - *I was not able to create a ribbon-like form which means there must be a lot of sand in this sample.*
            - *I easily could make a ribbon which means there must be more silt and clay particles which can stick together better than sand.*
    - Pose the following: "Using the results from this test what would you hypothesize about the water retention and water availability in this soil? What type of changes might you see with the changes of seasons"?
        - *Potential student responses:*
            - *If we cannot make a ribbon-like form with the soil, there might be more sand in the*

	soil which might not hold water very well.
	• *In the wetter seasons, winter and spring, there will be more water in the soil. If there is only silt and clay present, the water may pool and not trickle down to reach plant's roots.*
	Have students discuss answers to these questions with an elbow buddy and then share out in smaller groups. **(F2)**
	
	Soil Chemistry (pH test): (Can be done inside or outside)
	• Explain to students that the next test will be about the chemistry of the soil. A test that scientists will often perform is a pH test. *(See above for information about pH and how it affects soil)*
	  o The pH of the soil helps us to determine the acidity of soil, which can then determine which types of plants can grow in that particular soil.
	  o To explain an acid, bring in vinegar or pickle juice as an example.
	• Have students work in pairs to test the pH of the soil samples they have collected
	  o Instructor may bring in a couple soil samples that are not from around the school for students to compare and contrast.
	• Using the pH kits students will mix a sample of each soil sample with water and then using the provided test strips they will record the pH of each soil sample. *(instructions are available in the kits)*
	  o Students can record their results in their naturalist journals by labeling their soil sample (Soil Sample 1: outside school) and write or draw the results that appear on the test strip.
	• On the board draw out a table for students to record their pH data they have collected. This will give the entire class the opportunity to visually see the results.
	  o Pose the following question: "What similarities or differences do you see between the samples?" "Why do you think these exist?"
	  o *Potential student responses:*
	    ▪ *The samples from our school have a lower pH than the samples brought in from the other location, which means the soil near our school is more acidic.*	

Elaborate: Approximately 15min	**I used to think …but now I know:** • Students will be asked to compare their ideas about soil at the beginning of this lesson to what they have learned. • Students will make a recording sheet (*example given below)* that consists of two columns. They can discuss ideas with a	• Comparing results will increase higher order thinking through

	partner before recording their ideas individually. o Responses can be a combination of drawings, bulleted ideas, and complete sentences. Ask a few students to share their responses. **(F3)**	analysis. • Discussion with a partner will increase interaction and higher order thinking through comprehension. • Responses can be drawings, words, bulleted ideas, and complete sentences based on level of ELLs. • This activity will link prior knowledge with new learnings.
	Evaluations and Assessment Check ins: **(D1):** A quick review of what students know about abiotic factors. **(D2):** These questions will help access student's prior knowledge about soil to see what they know about how different soils support different vegetation which then supports different wildlife. It is getting at their knowledge and identification of those interdependent relationships that exist in an ecosystem. **(F1):** Students will be asked to create a model in their journals that demonstrate the three different particle size that exist in the soil and their importance in water retention and water leaching. **(F2):** Through this scientific test, students are able to apply what they learned in previous activities in order to determine the composition of the soil sample they are testing and predict its water retention capability. **(F3):** A self-assessment and reflection exercise that helps students recognize if and how their thinking has changed throughout this lesson.	• Assessments will activate prior knowledge, increase interaction through partner work and discussion, and increase higher order thinking. • Assessments will focus on appropriate hands-on evaluations to determine what student can do and have learned. • Scaffolding of step-by-step instructions

		will be used to help ELLs. • Modeling will be used for each scientific method.

References:
Dr. Kyle Palmquist's video