



Year 1

Fall Lesson 4: Soil Composition

Objectives

Students will be able to:

- Explain what soil is made up of and why it's important
- Accurately distinguish between the four soil types and know which type is best for growing gardens

NGSS Primary Standard:

5-PS1-3 Make observations and measurements to identify materials based on their properties.

NGSS Supporting Standards:

2PS1-1 Plan and conduct an investigation to describe and classify different kinds of materials by their observable properties.

2ESS1-1 Use information from several sources to provide evidence that Earth events can occur quickly or slowly.

Lesson Length

45-60 minutes

Materials

- Glass jar for WAMO
- Cups with materials to represent WAMO- water, sticks/leaves, rocks, empty cup
- Examples of the four types of soil
- Paper plates for making loam, spoons

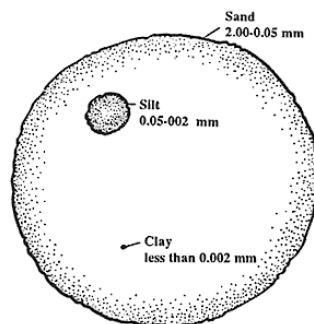
Summary

During this lesson students will get serious about sediments! Through observation and exploration, game based learning and soil sediment testing, students will get their hands dirty and feet moving to learn more about the earth beneath them.

Background

Soil is the backbone of any garden. It's a complex mixture of water, air, minerals and organic matter (WAMO). Good soil for gardening has what's called tilth- loamy, nutrient rich soil. Soil provides the structure and nutrients that plants need to survive. The type of soil you're working with in a garden tells you what plants to grow, how much and how often to water, what types of fertilizers and amendments you'll want to use and even what type of garden beds you should make. But you can't know any of this without first understanding what the different types of soils are and their characteristics.

Soil Types



Sand has the largest particles. It is made from small bits of rock and minerals. It's loose, with lots of room for the easy flow of air and water, but has little nutrients. It also dries out quickly. A garden in sandy soils will need lots of organic material and compost added for water retention and nutrients.

Silt is the next in size. It's made from pieces of soil and rock and has more nutrients than sand. Silt is a productive type of soil for gardening.

Clay is the smallest of the soil types, made of small mineral particles that stick together strongly. So much that plants' roots have a hard time growing through it. Clay is also very difficult for water to get through, causing water to sit on the surface of the soil when the ground is saturated or to only dampen the top layer of soil during dry months. It does, however, have a lot of nutrients that are great for plants.

Materials Continued

- Soil bingo sheets, dry erase markers
- Texture by feel sheets, dry soil, water
- Large sheets of paper w/crayons or worm observation materials

Preparation

This is a three part lesson: garden tasks, parts of soil, and soil bingo. It works best if you've set up your cups of WAMO materials and soil types before class starts. Decide where each rotation will be and make sure that you know what needs to be done to the garden to get it ready for winter.

Vocabulary

soil, sand, silt, loam, clay, minerals, organic matter, compost

Garden Tasks

- Examine, build and/or harvest compost
- Add organic material to beds that are high in clay, or sand
- Mulch garden beds with leaves and/or burlap
- Any other needed garden clean up for the winter- take out the last of the dead annuals and make sure the water is turned off to prevent over winter pipe damage.

Loam is a mixture of all three soil types and is the best type of soil for gardening. The sand allows for aeration of the soil, the clay adds important nutrients and the silt gives the soil body and fertility. Add some more organic matter in the form of compost and you have the perfect mix for a great garden.

Procedure

Classroom Introduction

Begin by asking the class why soil is important. Write WAMO somewhere for the students to see. After a minute explain that you need four things in order to have soil. Bring out your "magic" soil making jar. Give each table group a cup with one part of WAMO in it: an empty cup (representing air), water, rocks/minerals, leaves/sticks (organic matter). Give them a minute to look at what is in their cup, decide what they have and how it relates to soil.

One at a time go over each part of WAMO. Go to the table group with that part and have them dump it in the jar (even the air) and share why they think that part is important for soil. When everything has been added shake up the jar dramatically and then show the students the jar. Ask them if you now have soil. Explain that you don't. There's one last step before these things will become soil- they need to break down or decompose. Explain that it can take a long time (around 500 years) to make new soil, which is why we need to take care of the soil we have.

Supporting Activities

Soil Sediments Inquiry Station

Pass around examples of each type of soil for the students to examine (sand, silt, clay, loam). Ask them to be thinking about which type of soil they believe is going to be best for growing gardens. Have a show of hands for each of the four types of soil to see which one they think will be best. Then explain that you are going to do a demonstration to see which is right.













Water and Sediments Game

Begin by having students line up shoulder to shoulder in one or two groups (depending on group size). Explain that they are all going to be the different types of soil. First they will be grains of sand. Have them spread apart so that their fingers are touching. Ask for a volunteer. This volunteer is going to represent water. Water will weave his or her way between all the grains of "sand" under the arms. Time how long it takes

water to get through all the grains by having the group count out loud. Once they're done ask how difficult it was for water to get through the sand. Explain why it wasn't very hard and how this might affect garden plants.

Next, go through each of the other soil types, using the information below. Pick someone new to be water each time and keep timing them. If all goes well, it should take the longest for them to get through clay than silt or loam with sand being the quickest. (*This depends on the kids picked to be water and how fast they are moving*). To offset any weird timing results discuss the difficulty level of getting through each type of soil.

Soil Type	Kid formation	Soil Characteristics
Sand	Students stand in a line facing you with fingers touching	<ul style="list-style-type: none"> • largest of the four types of soil • particles visible by the naked eye • a lot of space between particles • doesn't stick together, water goes between particles easily • dries out too much on hot days for plants to survive well • low in nutrients
Clay	Students link arms and stand with little space between (remind them that they can't push in their legs to keep water out)	<ul style="list-style-type: none"> • smallest of the soil types • sticks together very strongly • really hard for water to get between the particles • Areas like wetlands with standing water often have clay soils. • high in nutrients • hard for plants to access them (roots can't penetrate clay easily)
Silt	Students stand with their hands on their hips, elbows touching	<ul style="list-style-type: none"> • in between clay and sand in size • more nutrients than sand, but less than clay • holds some water, not too much
Loam	A mixture of the first three. Some students linking arms, some elbow to elbow, some with fingertips touching	<ul style="list-style-type: none"> • Best type of soil to grow garden plants • a mix of the three other soil types • Sand keeps the soil aerated • Clay in it adds nutrients • Silt gives it body. • Last ingredient is organic matter in the form of compost. This makes the soil alive and healthy- perfect for growing plants.

 leaf	 worm	 roots
 insect eggs	 twig	 seed
 fungus	 spider	 clay
 sand	 rock	 insect

Soil Bingo

Use the bingo card (*left: found in materials section*), or make one of your own. Explain that each student will be getting a bingo card and be searching for items on the card. Whatever they find has to be in the garden. Whenever they find something they should come back to you and you will mark their card for them. They should not bring the actual item to you because we do not want to disrupt or

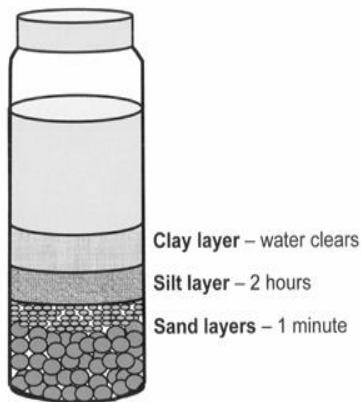
kill anything in the garden. Once they've got a bingo, they can go for a black out. For older students, have them explain which category of WAMO their found item belongs in each time they come up to have their card marked.

WAMO Game

During this game students will learn 4 hand and body signals one to represent each part of WAMO: water, air, minerals, and organic matter. This game is played with one person (you to begin with) as the leader. The leader will turn their back to the students who will each pick one of the 4 signs and act out its motion. When you yell "WAMO" you will turn around doing one of the 4 signs. Any student with a matching sign comes to join you. The last person in the line is the winner and can now be the WAMO caller if there is time. You can continue this game until the end of the rotation.

Wrap-up: Soil in a Jar Demonstration

To wrap up the lesson, gather students back together and let them know that we will now be testing our own garden soil to see if we have good loam (an equal amount of sand, silt and clay). Ask students how they would normally remove dirt from something (washing with soap and water). Take a soil sample from about 6 inches below the soil surface and fill a clear jar about 1/3rd-1/2 full. Next, add a



small amount of soap (1Tbs laundry powder per quart) and then fill the jar with water. Have students shake the jar for 2-5 minutes. Explain to students that the sand (our biggest particle) will sink to the bottom of the jar. Silt will make a ring in the middle and the clay will all be on top. Have students brainstorm how they might determine how much of each sediment is in the jar (using a ruler and calculating). During the next lesson, students will be able to determine what their garden soil needs to be the most productive for plants during the spring!

Adaptations

To simplify

1) For a shorter session start with a 10 minute WAMO introduction and then just do two other 10 minute rotations depending on what you're wanting to focus on. The soil bingo game is really great for younger students (K-4) but could be cut out for older students (5-8).

2) You could also make the WAMO explanation another rotation for short sessions, skipping a big group intro all together.

To add complexity

1) Instead of doing the soil types demonstration to talk about the different types of soil, have older students use the texture by feel chart to figure out different soil

types. Give each pair of students, or group of three, a sample of a different type of soil. Then have everyone test their own garden soil to see what type they have. It's best to collect a sample of soil from 5 or 6 inches below the soil surface and it is best if it's dry. Then you can discuss how to improve their soil fertility. This could also be its own rotation with the soil demo another complimentary rotation.

2) This would be a good lesson to do seed balls with and talk about soil mixtures and the nutrients that seeds need to germinate.

3) If you have time at the end, let the students create their own loam mixture using sand, silt, clay, organic matter/compost and a bit of water. Explain that making good garden soil is like making a chocolate cake. You want it to be moist but not too wet, dark colored because dark soil has more nutrients in it and mixed up really well. You can use spoons to add the different soil types: 4 parts sand, 4 parts silt, 2 parts clay and as much compost as they think is needed until you get that dark rich color.

Rainy Day:

Do the WAMO intro as written above, then choose an option below. A lot of it depends on how the classroom is setup and how much extra space there is for activities. You can split things up into rotations but in classrooms with little room for moving around it's sometimes best to just do things as a whole group. See below.

1) After the intro, split into three rotations. One rotation will do the soil types demo, the second will check out the four types of soil and create a loam soil mixture, and the third will either do a shortened worm observation (Rotation 1 Spring 3) or play soil charades, where you give them each something that's important for soil and they have to silently act it out (water, worms, sand, etc.). You could also have that last group draw a big group picture of healthy garden soil and everything you find living and growing in healthy soil.

2) Option two is to do the WAMO intro, then pass out examples of each of the four soil types to each table group for them to examine. Have them decide which type they think is best for gardens and then pick volunteers to come up to the front to do the soil types demo for the rest of the class. This can be really fun with the whole class watching. Then have each table group mix up a batch of loam and finish out with worm observations, the group pictures of healthy soil or have each table group act out healthy soil for the other groups, giving them about 5 minutes to prepare their very short skit.



Unit Title: **Fun in the Dirt**

A STEM in the Garden Unit

Grade Levels

3-5th

Lessons: 10- 50 minute lessons

Major Concepts

Decomposition, Soil Structure, Waste Reduction

Best Season, Months

Fall, November and December

Overview/Big Idea

This is a brief summary of what students will learn. It identifies the unit's focus and real world connections.

- Soil is made of living and non-living components.
- Soil is a valuable and finite resource for humans and the rest of the food chain.
- Soil plays a vital role in nutrient cycling and waste reduction.
- Compost is a valuable resource that enriches soil.
- Compost is made when decomposers break down food and plant waste into hummus.
- Composting our food waste can reduce landfill input and produce a valuable commodity.

Content Standards

This section identifies which Oregon adopted Next Generation Science Standards and Common Core Standards are addressed in this unit.

2-ESS2-1 Compare multiple solutions designed to slow or prevent wind or water from changing the shape of the land (erosion control in the garden- application of leaves as mulch versus a living mulch).

K-2-ETS1-1 Ask questions, make observations and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool. (How do we reduce food waste in the landfill? How do we slow or prevent erosion in the garden? How do we introduce nutrients to our soil for our plants?)

K-2-ETS1-1 Develop a simple sketch, drawing or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem. (worm bin or compost bin)

3-LS1-1 Develop models to describe that organisms have unique and diverse life cycles but all have in common birth, growth, reproduction and death.

3-LS3-1 Heredity: Analyze and interpret data to provide evidence that plants and animals have traits inherited from parents and that variation of these traits exists in a group of similar organisms. (Worm observations.)

3-LS3-2 Use evidence to support the explanation that traits can be influenced by the environment. (Observe worms living in different types of soil- clay and loamy and compost rich) Observe for size and color.

3-LS4-3 Construct an argument with evidence that in a particular habitat some organisms can survive well, some survive less well and some cannot survive at all. (Veggie Sarcophagus, worm bin and garden bed decomposition experiment)

4-LS1-2 Use a model to describe that animals receive different types of information through their senses, process the information in their brain and respond to the information in different ways. (Worm senses experiments).

4-LS1-2 Make observations and/or measurements to provide evidence of the effects of weathering or the rate of erosion by water, ice, wind or vegetation. (Erosion mounds?)

3-5 ETS1-3 Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved (cloches versus non cloched spots).

5-PS1-3 Make observations and measurements to identify materials based on their properties (sand, silt and clay day)

5-LS2-1 Develop a model to describe the movement of matter among plants, animals, decomposers and the environment (soil food web model).

5-ESS3-1 Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment. (Soil ecologist visit, erosion control ideas, Love Food Not Waste visit- students generate questions to address this).

Student Outcomes

These are specific student outcomes for the unit and are aligned with the standards identified above, but aren't limited to those standards. Student outcomes describe the knowledge and skills that students should come away with at the end of the unit. They get at the end skills and abilities gained from participating in the unit. Use of Blooms Taxonomy: 6 levels of learning were used to help guide development of student outcomes. Student outcomes are included to provide greater focus and clarity to the unit.

- Students can identify the four components that comprise soil.
- Students can distinguish three distinct types of sediment: sand, silt and clay and the mix of all three- loam.
- Students set up, conduct and assess results from a food decomposition experiment.
- Students can identify soil dwelling organisms and explain their role in the ecosystem.
- Students create a diagram to explain ways to reduce food waste from the system.

Related Garden Activities

This section identifies ways the garden can be used to reinforce the concepts being explored during the unit.

- Soil observations
- Soil amendments
- Mulching (providing organic material- living and dead)
- Compost Building
- Insect “hunts”
- Applying compost or vermicompost.

Real World Connection and/or Professional Connection

This section lists the real world problems, global issues, challenges and questions addressed by this unit. It also identifies opportunities for exploration of real world locations and professions. It can include a field trip or a guest presenter.

- Walking Inorganic/Organic materials tour (around and in school).
- Field trip to Rexius Love Food Not Waste composting facility.
- Guest Speaker: worm farmer or soil ecologist
- Love Food Not Waste educators
- Issue: Food Waste Reduction
- Secondary issue: protection of soil, building a resilient soil structure.

Communicating with an Audience

This section identifies ways students can share what they’ve learned and experienced with the broader community.

- Food Waste Reduction outreach campaign
- Love Food Not Waste implementation during BEST

Essential Question/s

These are the open ended questions that drive inquiry about the main ideas of the unit. They are appropriate for the grade level and encourage intellectual exploration of the topic.

- What is soil?
- Why is compost good for humans and good for the ecosystem (environment)?
- Why is soil important to our survival?
- What can we do to reduce food waste in our school?

Key Vocabulary

These are words and terms relevant to the unit that may be new to learners. They require thoughtful introductions and opportunities for contextual use.

Soil	Minerals	Organic
Inorganic	Erosion	Decomposition
Compost	Mulch	Aerobic
Anaerobic	Environment	Hypothesis
Vermicompost	Invertebrates	Ecosystem
Nutrient Cycling	Sediments	Sand, Silt, Clay, Loam
Microorganisms	Bacteria	Fungus
Humus	Food Web	Nitrogen
Carbon	Inference	Opinion
Objective Observation	Landfill	

STEM Integration

This section identifies which STEM disciplines are utilized and how their use is integrated in the unit to build applicable skills and knowledge. This includes inquiry based learning, utilizing principles of engineering, applied mathematics and use of appropriate technology.

- Inquiry process
- Measurements for data collection (weight, temperature and length)
- Graphical representation of data
- Building a worm bin
- Using a Microscope

Teaching to reach all learners

This section identifies which teaching methods are incorporated to reach all learners.

Different learning modalities utilized: kinesthetic, artistic, analytical, environmental, verbal
Pairing students to solve problems
Introducing and utilizing new vocabulary throughout the unit.



Fun in the Dirt

Day 1- So, what is soil anyways?

Target Grade Levels

3rd – 5th

Essential Questions

Is soil made up of living and non-living components and is it essential for the production of food?

Objectives

Students will be able to: identify four major components that make soil.

STE(A)M Integration

Physical/Earth Science

NGSS and/or Common Core Standards:

5-PS1-3 Make observations and measurements to identify materials based on their properties.

Lesson Length:

55 minutes

Offsite Preparation:

30 minutes

Onsite Preparation:

10 minutes

Materials

- Unit Poster
- WAMO materials in containers
- 1 Clear Jar/container
- Journals for students

Summary

Students will get to know each other, the teacher and the topic. They will learn the four basic components of soil through games and create a journal to document their experiences.

Background

This first lesson's major goal is to set the tone for the unit and introduce the students to the topic which is soil. Remember to create and gather your materials ahead of time!

Soil is a valuable and limited resource. We rely on it to grow food crops. It is comprised of four major components: Water, Air, Minerals and Organic Materials. WAMO is an acronym that makes these parts easy to remember for students and teachers. Over time minerals weather from exposed rocky surfaces, erode and are transported. These combine with organic materials (or material that was or is alive) and the air and water from the atmosphere to form soil.

You will need an indoor or outdoor space protected from the wind that is big enough for two lines of students to face one another comfortably (think 10 kids lined up shoulder to shoulder facing another ten kids, with at least 7 feet of space in between the two lines). It should be clear of obstacles such as plants or desks.

Procedure

Introduction (10 minutes)

Today is the day to set the tone for the class (fun, safe and respectful) as well as to give the students an idea of what they will get to do/learn and why it matters. Be sure to establish, introduce or review group and individual behavior expectations through activities and brief lectures or discussions.

3-5 min. A way quick, engaging way to start is to have the kids guess our theme for the next month by giving the kids clues about it.

Here are some clues:

- It is so valuable some people call it black gold!
- It can be found most anywhere on land.
- It can be red, black, brown, tan or even grey.
- Without it we would starve.
- Parents don't like it when we get it all over our clothes! (if they still don't get it you can say it gets you dirty if you play in it.)

Garden Connection

Soil Observation (touch, site, smell)

Evidence of Learning

Journal Entries

Key Vocabulary

soil, dirt, inorganic, organic, observations, hypothesis

Have them raise their hands when they think they know what the topic is (no shout-outs). Once at least half of the group has their hands raised, call on them to let them guess. Keep this activity quick- no more than 3-5 minutes. Afterward, share what we'll be doing and learning. A unit poster with the big ideas or essential questions is helpful. (T chart with drawings to make it kid friendly.) Additionally, begin on this first day by bringing in the base of a collage on a poster board. Draw a brown line about $\frac{3}{4}$ up the page to represent the soil line. Each day, students can cut out and attach things you might find underground that they've learned about that day. By the end of the unit, a one of a kind collaborate art piece that doubles as a group assessment of knowledge will be created and can be displayed!

We will get to...	We'll find out...
<ul style="list-style-type: none"> ▪ Play in the dirt! ▪ Be scientists and run experiments using scientific equipment ▪ Explore critters ▪ Go on a field trip or have a guest speaker ▪ Make our own soil ▪ Help other people to learn 	<ul style="list-style-type: none"> ▪ What soil is made of ▪ Why it is important for people AND nature ▪ How can we help to make the earth's soil healthier and last longer ▪ What other people are doing to help make earth's soil healthier and last longer

Sample T-chart to share with students on Day 1

Activities (45 minutes)

WAMO: Write WAMO vertically (with room to fill in the acronym) on a white board. Then divide students into four equal groups. Give each group 1 minute and one of the WAMO components. Ask them to figure out what is in their jar and how it might help. Have the groups share what they think. As they share, you write down the ingredient's name (Water, Air, Minerals, Organic Materials). Now, explain that these are the ingredients that make up soil. Ask if they think we could mix these up and make soil in the next 30 seconds. Have them defend their answer (making a hypothesis). Test it and briefly discuss the results- soil takes a lot of time to form.

WAMO the game:

Explain that there is a fun game to help us remember WAMO! Line students up shoulder to shoulder, across from the leader (you). Teach simple and fairly stationary movements for Water (wave motion with a hand), Air (arms waving overhead), Minerals (hugging self in crouched position- think of a rock), Organic Materials (big O with arms overhead). Practice a few times until kids have the motions memorized.

Give directions: The object of the game is to not match with the

leader. The leader will turn their back to the students and decide on a motion to do when they turn around. Meanwhile, the students also each decide on a motion. The leader counts down saying “3,2,1 WAMO” then faces the students doing one of the motions. Any students doing the same motion joins the teacher’s side and do the same motion as the teacher. The last student left takes the leader’s role, if there is time. They can play until you run out of your allotted time for the game.

Setting up Journals: Students can write their name on the first page, review the table of contents page and number all of the pages. Once this is finished, they can decorate the cover.

Wrap-up: Have students journal for five minutes. After they finish in their journal they can add to the Underground mural with construction paper and glue (cut out shapes). Here are two potential journal prompts:

1. What are you most looking forward to about garden club?
2. What are the four components of soil? Choose one and explain why it’s important.

Adaptations

To simplify:

Option A: Take out first WAMO activity and explain the components verbally. Add in a trip to the garden to feel the soil.

Option B: Have pages pre-arranged in journal (students simply fill out information/do the activities).

To add complexity: Take students out to the garden to look at and feel a soil sample. Have them try to identify each of the four ingredients: Water (squeeze and feel for moisture), Air (squeeze it out), Minerals (feel for grittiness), Organic Materials (look for living organisms or dead and decaying mulch).

Rainy Day: Present the entire lesson, all activities can be done inside or outside.



Fun in the Dirt

Day 2 - Nature's Recyclers: Wonder Worms!

Target Grade Levels 3rd – 5th

Essential Questions

What role do decomposers play that is essential to the life cycle of organic matter?

Objectives

Students can identify soil dwelling organisms and explain their role in the ecosystem.

STE(A)M Integration

Student led inquiry; question/problem development; making objective observations

NGSS and/or Common Core Standards:

3-LS3-2 Use evidence to support the explanation that traits can be influenced by the environment.

4-LS1-2 Use a model to describe that animals receive different types of information through their senses, process the information in their brain and respond to the information in different ways

Lesson Length 50 minutes

Offsite Prep 10-30 minutes

Onsite Prep 10 minutes

Summary

Students will find, collect and observe worms, read *Diary of a Worm*, and play decomposer tag if there is time. While they collect worms they will get compare and contrast the soils they find the worms in, reviewing WAMO.

Background

Healthy garden soils are teeming with life. The earthworm is by far the most well known garden creature living underground. Earthworms are fascinating creatures that help enrich the soil by eating organic matter like dead leaves and then creating waste that releases nutrients back into the soil where plants roots can access them. This is decomposition in action! Another benefit of having a lot of earthworms in your garden is that they turn and fluff the soil as they move through it. This is called aeration and is essential to good tilth.

Earthworms are a part of a large phylum of animals called the Annelids (segmented worms). There are over 17,000 different types of annelids. Some even live in the ocean. Scientists believe there are between 2,700-4,400 different species of earthworms! These are grouped by where in the soil they live and their behavior. There are three main groups: anecic, endogeic and epigeic. Anecic (“up from the earth”) are the nightcrawlers; worms that build burrows deep in the soil and take organic matter from the surface down into their burrows. They are the longest of the garden earthworms and are often used for fish bait. Endogeic (“within the earth”) worms are very small with little coloration. They rarely come to the surface of the soil and live in non-permanent burrows. Epigeic (“upon the earth”) are worms that live at the top most layer of the soil and move through the soil horizontally eating through organic matter. They are red and get up to 4 inches long. These are often used to make worm compost.

For additional kid-friendly resources about earthworms, please visit: <http://urbanext.illinois.edu/worms>.

Materials

- Unit Poster
- Collage
- Diary of a Worm
- Shovel
- Magnifying lenses
- Journals
- Worm Fact Sheet (optional)

Key Vocabulary

decomposers, habitat, ecosystem, worm castings, compost, microorganisms

Evidence of Learning

Journal Entries, Collage additions

Garden Connection

Worm Hunt

Procedure

Introduction (10 minutes)

Be sure to review names, rules and expectations in a fun way. You can use the book *Diary of a Worm* to introduce earthworms as a topic. After reading the book, you can talk with the kids about why worms are important for the garden and how they are harmless to people.

Activities (30 minutes)

Worm Observations

Explain that today they will be scientists and their challenge is to learn as much about the earthworms in our garden as they possibly can. Some potential questions to help shape their investigations are: *Do worms come in different colors? What is the range of length? Do different types of worms move differently? Where in the soil do worms live? What details do the magnifiers help you to see?*

Show them the tools (rulers, trays, magnifiers, anatomy card, water and organic matter). Explain that they can use these tools in any way that doesn't harm the worms. Explain that different types of worms live in different habitats. Ask students to identify some potential habitats. Set behavior boundaries around treatment of the worms (gentle hands, no tools to separate them, no direct sunlight, water when needed and put it back where you found it). Give the students a time limit to go exploring for worms (5-10 minutes is probably a good amount of exploration time).

After they explore, come back together as a group so they can share their observations. Before starting the discussion, introduce students to the idea that scientists learn from the observations they make, not from what they feel about something. Give an example or two if this is a new concept to the students. Prompt the discussion if kids are stuck by asking some of the questions listed above. After the discussion, check with kids to make sure all of the worms and tools are back in the right places.

Worm Centipede Bacteria: Version 1

After the discussion and after worms are all put back in their habitats, play a game of Worm Centipede Bacteria for fun!

Object of the game: This is a modified version of rock paper scissors, where each role is eaten by something else. The object of the game is to win the match up. In this game:

- Worm beats bacteria (the motion is to stand straight with your arms up in the air and hands clasped together)
- Bacteria beats centipede (put fingers together to make the sign for something really tiny)
- Centipede beats worm (put arms in and hands out and wiggle your fingers with a scary face)

This mimics the lifecycle of these creatures. Worms eat bacteria as they feed on organic matter. Centipedes are predators of worms, but when centipedes die, bacteria come in and break them down. Split the students into two shoulder to shoulder lines that are facing one another. You may have them play best 2 out of 3 or 3 out of 5.

Worm Centipede Bacteria: Version 2

They can also play a tag version of this game. Have each team huddle up and quietly pick the creature they will be. Then, they line up facing away from the other team. Choose a key term, like Food Chain to serve as the signal for the teams to quickly turn around showing their motion to the other team. If playing the tag version, the group that gets eaten must run to a predetermined line. If they are tagged before reaching it, they join the other team.

Wrap-up (10 minutes)

Have students' journal for five minutes. After journaling, kids can add worms to the murals. Encourage them to cut them out in shapes they saw the worms go into in the garden. Journal prompt: *If you were a worm, which type would you want to be- one that lives underground all the time, one that lives at the surface, or one that only comes up at night? Why?*

Adaptations

To simplify:

Option A: Have worms ready for students to observe.

Option B: Don't read *Diary of a Worm*.

To add complexity: Go through the scientific process with the students. Review the steps of the process. Have students record observations.

Rainy Day: Bring worms into the classroom for a more formal observation. See Worm Observation Worksheet in materials.



Fun in the Dirt

Day 3 – Veggie Vault vs. Vermicomposting Part 1

Target Grade Levels 3rd – 5th

Essential Questions

Is composting a way to reduce food waste and create something of value?

Objectives

- Students set up, conduct and assess results from a food decomposition experiment.
- Students can identify soil dwelling organisms and explain their role in the ecosystem.

STE(A)M Integration

Complete Guided Scientific Inquiry project; Applied engineering through designing an airtight vault and a hospitable habitat for red wiggler worms.

NGSS and/or Common Core Standards:

K-2-ETS1-1 Develop a simple sketch, drawing or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem.

3-LS4-3 Construct an argument with evidence that in a particular habitat, some organisms can survive well, some survive less well and some cannot survive at all.

Summary

Students will begin an experiment to compare how food decomposes in an anaerobic environment (mimicking landfills) versus in an aerobic environment (compost system). They will design the veggie vault and worm bin and develop a hypothesis.

Background

Decomposition is the process by which organic substances are broken down into a simpler form of matter. The process is essential for recycling the finite matter that occupies physical space in the biome.) It is the step that closes the loop of the energy and nutrient cycles in an ecosystem.

(<https://en.wikipedia.org/wiki/Decomposition>)

Decomposers are organisms that feed on dead and decaying matter. In a sense they are nature's cleaners. Their waste enriches the soil with nutrients that plant roots can easily access.

Most decomposers need the right habitat to do their job. This includes the right quantities of water, air, and food as well as a temperature that is conducive to their needs. However, landfills, where much of our food waste is dumped are designed to keep air out (for safety reasons). This creates an **anaerobic** environment where very few organisms survive. For this reason, much of the food we throw away takes many years to decompose. As the food and other trash continues to pile up we run out of room. This is a major challenge that city planners are working to address. One solution is to separate food waste from the waste stream and create an environment where decomposers can thrive. Examples of this can include commercial composting systems which break organic materials down in large quantities to be reintroduced to soil by community members. Programs that do just this are beginning to pop up in many cities throughout the world. One such program is the Love Food Not Waste Program in Eugene, Oregon. Visit their website to learn more about the program: <https://www.eugene-or.gov/index.aspx?NID=759>.

In this lesson students will have the opportunity to simulate and compare landfill and compost environments by making small scale models of each and then testing the rate of decomposition of food items. To prepare for this lesson, you will need to gather all materials and supplies ahead of time. Also, take a little time to familiarize yourself with red wigglers, or *Eisenia Fetida*, the species of red worms used in worm composting systems. Here is a great website to teach you about this fascinating species and how to create your own worm bin: <http://www.redwormcomposting.com/getting-started/>

Lesson Length

50 minutes

Offsite Prep

30 minutes

Onsite Prep

10 minutes

Materials:

- Journals
- 5-10 empty plastic water bottles
- Scissors
- Worm fact sheet
- Duct Tape
- Sharpies
- Paper
- String
- Tape
- 5-10 quart containers with lids
- Nails
- Hammers
- 5 Wood blocks
- Inquiry poster
- Collage
- Unit Poster/Mural
- Book: *Diary of a Worm*
- shovel
- magnifying lenses

Key Vocabulary

Scientific Process, hypothesis, simulation, observations, anerobic, aerobic, ecosystem, food web, habitat, inhospitable

Garden Connection:

Extentions: Bury some food samples deep in a garden bed and mark it with a flag for a third data collection point.

Evidence of Learning:

Completed worm bin and veggie vault, Journal Entries, Mural

Procedure**Introduction (10 minutes)**

Give students 2 minutes to draw a scientist. Then ask them, how many of them drew themselves? Explain that we get to be scientists and run an experiment that could make a difference at the school.

Now tell them that the experiment we are going to run is called Veggie Vault vs. Vermicompost. Explain what each thing is; a veggie vault is a landfill simulator, and a vermicompost is a miniature worm farm. Explain that landfills are made to basically be a giant container for the things we don't need or want anymore. Like a container they minimize the amount of water and air coming in or going out. This keeps the system safe and from being too stinky. On the other hand, the worms in vermicomposts need air and water to survive so these systems are not totally sealed off.

Explain that we will be making simulations of each environment to see what happens to food when it goes into each system. We will be recording what happens along the way and then discovering an answer to the question "Is there a difference between what happens to food that goes to the landfill vs. food that goes to a compost? What is that difference?"

Share that today, their job is to design and build the two systems and also come up with a hypothesis or best guess based on what they already know. Show them their materials and the get started.

Activities (35 minutes)**Building the Veggie Vault**

Divide the group into smaller teams of about 3 students per team. Show the teams the materials for this project (1 liter bottles, scissors, duct tape, anti bacterial spray and a paper towel and food waste) and explain that it must be airtight and not let any light in once the food has been inserted. Give the teams 3-5 minutes to discuss a plan for their Veggie Vault. Give them an additional 5-6 minutes to create their vault. Once all teams have finished initial construction have them share their designs with each other. Encourage them to explain what they like about their design and what could potentially be a weak point.

Building the Vermicompost

Have the groups work in the same smaller teams to construct their worm bins. Worm bins can be as simple as quart sized yogurt containers. With the help of an adult, let students hammer breathing holes into the container's lids. This requires a small piece of wood underneath the lid, a nail and a lot of attention to safety. Be sure to

go over safety with students before beginning. After lids have holes, allow students to observe and share their thoughts about the materials that will go into the worm bin: Bedding (hydrated coconut coir and/or black and white newspaper), air and moisture.

Share that the bedding is made of carbon and will provide carbohydrates to the worms, just like rice, pasta, and bread does for us. Have each student squeeze the excess water out of a handful of coir, then place it in the bin. After that, ask the kids “How could we make it easier for the worms to decompose the paper?” Guide the students to the idea that by breaking them apart into small pieces, we increase the surface area of the food sources, which makes it easier for the worms (who have very tiny mouths) to consume the foods. Then have the kids tear the paper into very small pieces (1/4 inch is ideal). One student can mix the coir and paper so that the paper doesn’t blow away.

As students finish constructing and setting up both systems, be sure to have them label and decorate the outsides of the containers.

Hypothesis development

Gather the group in a circle and share that each team will get a different type of food waste to put in their containers. Ask them, “What do you think will happen to your food after one week? What do you think will happen after two weeks? Why do you think that?” Let the group discuss this for 3-4 minutes. Give them 3 minutes to record their predictions in their journal.

Wrap up (*5 minutes*)

As your wrap up have them journal their predictions for one week and for two weeks. They can draw, or describe how they think the food waste will change over time in the Vault and in the Vermicompost bin.

Adaptations

To simplify

Option A: Have a sample Vault and Bin already constructed as a model for kids to replicate.

Option B: Complete a group hypothesis instead of having the students journal their own hypothesis.

To add complexity:

Option A: Go through the scientific process with the students. Review the steps of the process. Have students record the steps of the process in their journals as they complete them.

Option B: Include a third location to test decomposition such as the school garden’s compost bin or at least 1 foot under the soil of a garden bed.

Rainy Day: Lesson can be completed outside or indoors.



Fun in the Dirt

Day 4 – Veggie Vault vs. Vermicomposting Part 2

Target Grade Levels
3rd – 5th

Essential Questions
How can we use vermicomposting to reduce food waste and create valuable compost?

Objectives
Students set up, conduct and assess results from a food decomposition experiment.

STE(A)M Integration
Complete Guided Scientific Inquiry project; Applied engineering through designing an airtight vault and a hospitable habitat for red wiggler worms.

NGSS and/or Common Core Standards:

3-LS4-3 Construct an argument with evidence that in a particular habitat, some organisms can survive well, some survive less well and some cannot survive at all.

Lesson Length
50 minutes

Summary

Students will begin an experiment to compare how food decomposes in an anaerobic environment (mimicking landfills) versus in an aerobic environment (compost system). Today they will measure and add the food waste to their two systems and record their first set of data.

Background

See *Background for Lesson 3*

Additionally, for information on how to guide a scientific inquiry visit Oregon Department of Education's Scientific Inquiry How To Sheet: <http://www.ode.state.or.us/teachlearn/subjects/science/resources/inquiry.pdf>

Procedure

Introduction (10 minutes)

Begin with an apple, bread, kale and banana snack. Be sure to use enough apples and bananas to have cores and peels left over. These, as well as some leftover kale and bread will become the food waste for your two systems. An easy way to incorporate math is cutting the apple in even parts and as accurately as possible for measurement (note that the teacher should be cutting the snacks, not the students, though they could split bananas, bread and kale by hand).

Activities (35 minutes)

Once the snack is completed, have students retrieve their vault and their bin. Now it is time to put the food waste into the systems and collect their first round of data! Have them open and sanitize their vault.

Now have them weigh and measure their food waste objects. Use grams and centimeters. They can measure length, width or

Wrap up (*5 minutes*)

Students can add their data to the data chart (above). Go over the data and their predictions again with the whole group. Finally, students can add to the worms or compost/food waste to the group mural.

Adaptations**To simplify**

Run the entire experiment as a whole group with all of the food options going into one vault and one larger worm bin.

To add complexity

Consider adding a fruit sticker or another small piece of plastic to each bin OR a biodegradable plastic. This could lead to a discussion of how decomposition works over time and/or the relative permanence of plastics.

Rainy Day: Lesson can be completed outside or indoors.



Fun in the Dirt

Day 5 – Sediment Explorations

Target Grade Levels

3rd – 5th

Essential Questions

Is soil made up of living and non-living components and is it essential for the production of food?

Objectives

Students can distinguish three distinct types of sediment: sand, silt and clay (in combination-loam)

STE(A)M Integration

Identifying sediment type by touch and visual observations, use of microscopes and magnifying equipment, building and using a replica to extrapolate characteristics of different soil sediments.

NGSS and/or Common Core Standards:

5-PS1-3 Make observations and measurements to identify materials based on their properties.

Summary

Students will explore soil sediments by creating magnified replicas using balloons and through visual and tactile experiences in the garden.

Background

According to Soil Science Society of America soil science glossary, soil is defined as “the unconsolidated mineral or organic material on the immediate surface of the Earth that serves as a natural medium for the growth of land plants.” In addition to containing mineral and organic matter, it also contains varying quantities of water and air, as is explored in “*Lesson 1- So, what is soil anyways?*”.

This lesson explores the mineral materials that can be found in soil. Good soil for gardening has what’s called tilth. It is loamy, nutrient rich soil. Soil provides the structure and nutrients that plants need to survive. The type of soil you’re working with in a garden tells you what plants to grow, how much and how often to water, what types of fertilizers and amendments you’ll want to use and even what type of garden beds you should make. But you can’t know any of this without first understanding what the different types of soils are and their characteristics.

Minerals in soil vary depending on regional geologic history and come from sources of rock that has weathered, eroded and been transported as sediments. In soil science these sediments are categorized by their characteristics such as size, texture and shape. There are three major categories of sediment found in soil. These are sand, silt and clay. When found in combination, the resulting mixture is called loam. The type of sediment found in a given soil impacts soil density, how water and air move through soil, as well as nutrient content and accessibility for plants. For this reason soil types are often described based on the sediments present.

Preparation

Consider how to best manage balloons with kids

Lesson Length

50 minutes

Offsite Prep

15 minutes

Onsite Prep

20 minutes

Materials:

- Balloons (100)
- Bike tire pump
- 3 Medium sized boxes
- Sediment samples
- Journals
- Collage materials

Garden Connections

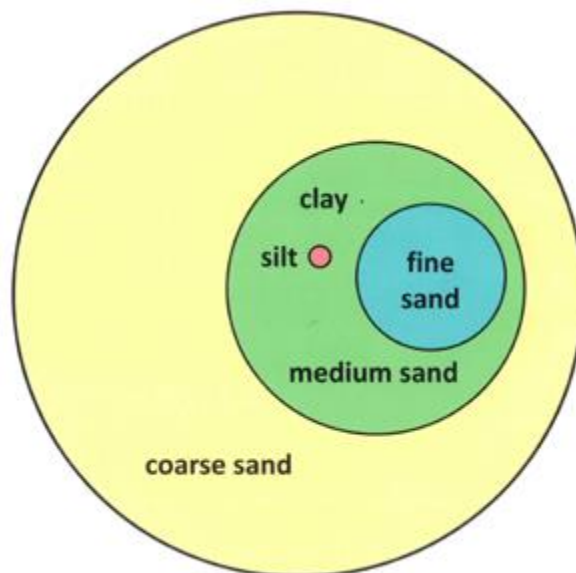
Soil sample explorations

Evidence of Learning

Discussion and questions during presentations

Key Vocabulary

sediments, weathering, erosion, sand, silt, clay, minerals, inorganic materials, replica



Sediment size comparison, found at:

<http://www.ext.colostate.edu/mg/gardennotes/213.html>

Sand has the largest particles. It is made from small bits of rock and minerals. It's loose, with lots of room for the easy flow of air and water, but has little nutrients. It also dries out quickly. A garden in sandy soils will need lots of organic material and compost added for water retention and nutrients.

Silt is the next in size. It's made from pieces of soil and rock and has more nutrients than sand. Silt is a productive type of soil for gardening.

Clay is the smallest of the soil types, made of small mineral particles that stick together strongly; so much so that plants' roots have a hard time growing through it. Clay is also very difficult for water to get through, causing water to sit on the surface of the soil when the ground is saturated or to only dampen the top layer of soil during dry months. It does, however, have a lot of nutrients that are great for plants.

Loam is a mixture of all three soil types and is the best type of soil for gardening. In a well balanced loam, sand allows for aeration of the soil, clay adds important nutrients and silt gives the soil body and fertility. Add some more organic matter in the form of compost and you have the perfect mix for a great garden.

To learn more about soil tilth and sediments visit Colorado State Extension document: <http://www.ext.colostate.edu/mg/gardennotes/213.html>

Procedure

Introduction (5 minutes)

Start by showing three balloons blown up to various sizes. Explain that soil is made up of lots of small particles called sediments. Tell them that these balloons represent the three major types of sediments: sand, silt and clay. The balloon representing sand should be as large as possible. The silt balloon should be about 1/10th of the size and the silt balloon should be about 1/50th of the size, if possible. Sediments are bits of rock that have gotten "WET" (weathered, eroded and transported) and ended up in the low spots in the watershed. Now let the students feel three sediment samples- a sandy one, a silty one and a clay one. Ask them to describe those sediments based on texture. Help them to brainstorm specific descriptive words.

Explain that the sediments in the soil determine how dense and full of nutrients the soil is. Briefly explain that we are going to create a magnified (literally blown up) replica, or model, using balloons of sandy, silty and clay heavy soils to try to figure out what the benefits and drawbacks to each type of soil might be. Then at the end of the lesson we will learn what soil scientists say and see if we were right with our predictions based on our replicas.

Activities (35 minutes)

1. For this replica, you'll need to divide the group into a SAND team, a SILT team and a CLAY team (each team should have 3-4 members). Each team will have 8 minutes to blow up and tape together a set number of balloons (15-20) to create a replica sediment layer. Each team will also get a box to use as the structure for their replica.

Note: students should NOT tape the balloons to the box, they should only tape balloons to other balloons. Consider giving the SAND team a bike pump to expedite the blow up process. Also note that additional adult helpers are needed to run this lesson successfully. Many kids struggle with the fine motor skills required to tie a balloon.

2. After all the groups finish, have one team at a time unveil their replica by removing it from the box. Ask the audience to identify the differences between the replicas. What do they notice? Some key observations that they should see is that SAND sediments are much larger than the other two and that the spaces in between the particles are much bigger than those in between the SILT or CLAY replicas. Ask the students, how might water move through each type of soil? Why does that matter? What about air? How might the temperature of sandy soils change differently than the temperature of clay soils?

3. Once the demonstration is completed, ask students to journal (or pair share, as time allows) about what type of soil they think might be most beneficial to have in our garden based on water movement, air and temperature. If they have journaled their thoughts, consider having them share their ideas with the group. Some simple guiding questions include: What would be good about having a soil

with that type of particle? What might be bad about it? If needed, give them a clue by reminding them of WAMO (with a focus on the water, air and organic material).

Explain that farmers and soil scientists will tell you that the best soil has a combination of all three of these sediments. Soils like that are called LOAM. An ideal loam is 20% clay, 40% silt and 40% sand.

(<http://www.ext.colostate.edu/mg/gardennotes/213.html>)

Wrap up (10 minutes)

Go out to the garden and feel soil samples from the school garden. Teach kids how to feel for the different particles (by balling the soil up and tossing it to let it fall back in your hand and break open) and by rolling it between your fingers to make a soil ribbon. Have them use their new knowledge to assess the soil and decide if it is mostly sand, silt or clay. With the time that is remaining, students can dig soil samples at different depths and compare them if that is of interest, or work on appropriate gardening tasks.

Adaptations

To simplify

Pre-inflate the balloons, and have students just tape them together in the mold. Also, you can omit journaling reflections and simply guide a group discussion.

To add complexity

Option A: Invite a soil scientist in to co-teach the activity.

Option B: Teach students how to use the ribbon test to assess soil using a guide sheet after completing the replica.

Option C: Alternatively, have the principal or another person from the school come to hear from the students about their findings and suggestions on ways the school might reduce its food waste going into the local landfill.

Option D: If there is time, have students write letters to the school principal asking about how food waste is being disposed of and suggesting that they consider composting it.

Rainy Day: Lesson can be completed inside by bringing garden soil samples into the classroom. It can also be completed outdoors, but in an area that is protected from wind.



Fun in the Dirt

Day 6 – Fun with Clay and Compost Bingo

Target Grade Levels

3rd – 5th

Essential Questions

Is soil made up of living and non-living components and is it essential for the production of food?

Objectives

Students will create artwork representing soil dwelling organisms

STE(A)M Integration

Using art to interpret information, outdoor scientific exploration

NGSS and/or Common Core Standards:

4-LS1-2 Use a model to describe that animals receive different types of information through their senses, process the information in their brain and respond to the information in different ways

Lesson Length

50 minutes

Offsite Prep

10 minutes

Onsite Prep

15 minutes

Summary

Students will learn through play and exploration to increase familiarity with the organic and mineral components of soil.

Background

Soil is more than dirt. Living and non-living components combine to form this very valuable resource. Without it, we could not survive. It is also fun to explore and play with. After multiple lessons focused on learning through inquiry and engineering, now it is time to learn in a different way; through play!

Kids will be exploring the compost pile and finding invertebrates. They will also be playing with clay, one of the most commonly found soil sediments.

As the educator, getting familiar with the various organisms that are commonly found in the compost pile is very helpful. Use the Compost Bingo Cards found in the resources and materials for this lesson with students in the garden to explore the compost pile before the lesson. Dig around a bit with a stick or hand trowel. Look under logs and buckets. The invertebrates in your school's garden will be there. Invertebrates are organisms that do not have an endoskeleton.

Procedure

Introduction (3 minutes)

Explain to students that today they get to play with clay and explore the compost for worms and lots of other compost invertebrates.

Materials:

- Compost Bingo Cards
- Collage materials
- Clay
- Cleaning supplies for after clay
- Clip boards
- Tray and parchment
- Journals

Garden connection

Compost Explorations

Evidence of Learning

Clay sculptures

Key Vocabulary: Clay, sediments, organisms, habitat

Activities (40 minutes)

Start with the compost exploration: Explain what an invertebrate is. Here is an easy break down of the word: 'in' means *not* and 'vertebrate' is *an organism with vertebrae or a backbone*. Have them feel for their own backbone by bending forward with a curve in their back and feeling the bumps of their vertebrae. Ask them to identify other creatures that are vertebrates (birds, mammals, fish, etc.). Now ask them examples of invertebrates (slugs, octopus, crabs, spiders, etc.). Share that there are all kinds of invertebrates in the compost pile! Some are predators, some are consumers and some are decomposers that eat dead and decaying materials like the worms we studied.

Compost Bingo

Give each pair of students 5-10 minutes to explore the compost using a laminated bingo card as their guide. Explain that their goal is to find and check off as many of the things on the bingo card as they can. Explain that they can go for a bingo, an x out (finding all the invertebrates or other materials in the diagonal squares of the bingo sheet) or a black out (finding everything on the sheet). Provide the students with a wet erase marker to use with their Bingo Sheet.

Remind them that compost invertebrates are also found outside of the compost pile. Ask students to brainstorm other locations they could find these critters (under logs, in wood piles and in the corners of garden beds, etc.)

Be sure to provide boundaries for where the students can explore and have them revisit expectations around being safe by not touching creatures that might bite or sting for protections, as well as being kind to all living creatures and being respectful to others. If the group is a little reserved about exploring for critters, model how to find them. Show enthusiasm and safe practices around

invertebrates. Look under logs and share out loud when you've found something exciting (hint: by making any discovery of an invertebrate exciting, the kids will get excited too).

Once students have begun to slow down on their explorations, gather the group to have them share their most interesting discoveries! To wrap up the Compost Bingo share that all of these creatures make up a web of life. They are all dependent on one another to survive. Our soil is a part of the that web. Without these creatures, the soil can not be as healthy and won't be able to grow food that is as nutritious and tasty!

Play with Clay: Now it's time to transition to playing with clay. Have students wash hands thoroughly if they got dirty. Then, have them find a seat in the designated

area. An indoor area with tables works best, though you could also use clip boards as personal mini tables for students if you are outdoors.

Review with students about sediments by asking what clay is (a very fine, small sediment found in soil). Share that its ability to hold moisture and exclude air has made it an incredible resource for humans through history. People have made clay pots for holding water and food for thousands of years. It has also been used to make art for just as long. Share that today, we will use the rest of the time to play and explore, then make clay invertebrate sculptures! They can even be turned into beads if the kids want. Be sure to use oven baking clay. Let students play for the first 5 minutes or so, then encourage them to transition to sculpting their favorite invertebrate that they saw today. Give students toothpicks and access to water to help with their sculptures. If students want to create their own invertebrate that is great too! This is mainly an opportunity for kids to relax, have fun and connect with the learning in a tactile and creative way. Model how to work with clay if you are familiar with it and if they are interested in learning techniques. At the end, leave the sculptures on a baking sheet with parchment paper underneath to take home and bake.

Wrap up (*15 minutes*)

As students finish their clay sculptures, have the Compost Collage, paper, and scissors ready for kids to come and cut out new creatures to add it.

Preparation for field trip or guest visitor: Share with students about the upcoming field trip opportunity. Have them think about what they want to learn and what they already know.

Adaptations

To simplify

Allow for free play with clay. Don't worry about restricting students to sculpting invertebrates. Just be sure that their sculptures are school appropriate (no guns or other inappropriate images).

To add complexity

One alternative lesson is to do a spa day with clay masks instead of sculpting with clay. This is a fun activity for all students and a novel experience for virtually all of them. You can talk about how the characteristics of clay help it to draw moisture away from your skin, pulling out impurities along the way. It is also just hilarious for the kids to see each other with clay masks on! Consider creating a relaxing ambiance (like a spa) by turning off the lights and playing relaxing music. Plan to take about 25 minutes for this activity if you choose to do it.

Rainy Day: Bring a large shallow bin (or two) into the classroom full of compost for exploration.



Fun in the Dirt

Day 7 – Learning in the World: Field Trip or Guest Educator

Target Grade Levels

3rd – 5th

Essential Questions Objectives

Is composting a way to reduce food waste and create something of value?

STE(A)M Integration

TBD

NGSS and/or Common Core Standards:

NA

Lesson Length:

TBD

Offsite Prep

30 minutes

Onsite Prep

5 minutes

Materials

- Journals
- Questions for guest teacher
- First Aid Kit
- Permission slips and Info sheets on each student

Key Vocabulary

TBD

Garden Connections

TBD

Evidence of Learning

Student engagement during presentation, Thank you card content.

Summary

Students will have the opportunity to learn from a professional sharing their real life experience or taking a field trip to a site dedicated to composting, to landfill management or to a worm farm!

Background

Here are three different local area businesses you can contact for a field trip:

- a. Commercial composting- Rexius and City of Eugene: (541-342-1835)
- b. Annie Donahue Common Ground Garden
- c. Lane County Waste Management: (541) 682-4120

Transportation and Safety: be sure to communicate with your supervisor before the unit begins to secure safe and approved transportation. You will also need to get permission slips signed by guardians as soon as possible. Remember to request additional support from an educational assistant or other educators if at all possible.

When coordinating the field trip anticipate any safety needs or concerns. Ask for the site coordinator's support. Also, be sure to communicate the age range of the students you will be bringing with you and also the number of students you expect to bring with you.

Procedure

Introduction (10 minutes)

Prepare students in advance for the field trip or guest speaker by letting them know who is coming or where they are going and how it is connected to what they've been learning about. Take 2-5 minutes for the students to think about and generate questions they may have for the speaker. Then, be sure to remind them that they are representatives of their school and their community. Go over the expectations for behavior if needed.

Activities (*Timing to be decided*)

Activities can be decided based on location/guest. Work to connect the experience to what students have been learning. Come prepared with questions and connections to help students draw meaning from the experience.

Model active participation during the field trip or guest speaker presentation. Create an opportunity for students to share with the guest speaker what they have learned over the last several weeks.

Wrap up (*15 minutes*)

Once back to the school, or the next session, have students handwrite and draw thank you cards. Refer back to this experience when working on the results and conclusion section of the Veggie Vault vs Vermicompost.



Fun in the Dirt

Days 8 & 9 – Veggie Vault vs. Vermicompost Part 3: The final weigh out and making sense of our data!

Target Grade Levels 3rd – 5th

Essential Questions

Is composting a way to reduce food waste and create something of value?

Objectives

- students set up, conduct and assess results from a food decomposition experiment.
- Students can identify soil dwelling organisms and explain their role in the ecosystem.

STE(A)M Integration

Scientific inquiry/ method, measurement and data analysis, discussion to draw conclusions and lessons learned from experiments

NGSS and/or Common Core Standards:

3-LS4-3 Construct an argument with evidence that in a particular habitat, some organisms can survive well, some survive less well and some cannot survive at all.

3-5 ETS1-3 Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.

Summary

Students will have the chance to open the vault and the worm bin to collect, record and analyze the data we find (weigh out food sources again) and make meaning from it!

Background

In addition to the background information found in Lessons 3 and 4 consider learning more about how landfills are designed and operated and why. This will help you lead a productive group discussion about the findings from this experiment! One good website for this type of information is the Mother Earth section of the Advanced Disposal website. Advanced Disposal is a disposal company that operates in 17 states: <http://www.advanceddisposal.com/for-mother-earth/education-zone/learn-about-landfills.aspx>

To learn more about red wigglers, you can visit:

http://www.eulesstx.gov/composting/vc_reproduction.htm

This city composting program in Euless, TX has great information about the life cycle of red wigglers which will be of interest to students. Here is an excerpt from their site that may provide other helpful information:

“Under favorable conditions your red wiggler worm population will multiply rapidly. A mature red wiggler (3 months old) can produce two to three cocoons per week. Each cocoon averages three hatchlings. Cocoons take up to 11 weeks to mature and hatch. Hatchlings require two to three months before they grow to be mature breeding worms. **Population productivity over 11 week incubation period:**

1 worm x 3 cocoons/wk x 3 hatchlings/cocoon = 9 hatchlings/wk

11 weeks x 9 hatchlings/wk = 99 hatchlings/worms

Lesson Length

50 minutes

Offsite Prep

15 minutes

Onsite Prep

10 minutes

Materials

- Vaults and Bins
- Rulers
- Scale
- Impermeable gloves
- Trays
- Materials for collage
- Journals

Garden Connections

Visit to compost bin

Evidence of Learning

Group dialogue during vault and bin opening, journal data entry and group data entry and active discussion during results portion

Key Vocabulary

decomposition, landfill, compost, scientific process, results, conclusion, food waste reduction

Procedure**Introduction (5 minutes)**

A brief note: This 2 day lesson is very heavy on analytical thinking and requires longer periods of focus and reflection. If and when, at any point, the group needs a break, consider playing a fun energy releasing tag game of your choosing. One fun and easy way to connect the tag game to the theme is to play robin and worm tag. In this version of tag, one student is the robin (it) and the rest are worms. When a worm gets tagged, it becomes a robin egg/chick and must stand in place. However, if a worm comes by it can reach out and tag it. Then that worm becomes an egg/chick. The game ends when there is only one worm left!

Share that today is the unveiling of the Veggie Vault and the Worm Bin!!! Build their enthusiasm with your own. It will have been two weeks since you last visited this topic. Be sure to revisit the group hypothesis and ask students if they have any last changes to their hypothesis based on their Learning in the World Day.

Activities (40 minutes)

Some words of advice: begin with the worm bin this time. This is because it should be less stinky. Students should use gloves. To assess the food waste, dump out all of the material from the bin onto a clean tray. Then let students sift through the materials. Have them start by separating the remains of the food waste and measure and record the data. After, they can record their qualitative observations.

At your discretion, students can take home the worm bins if they would like to. Just be sure to send them home with a note and instructions on how to care for them. They can be released by families as well if they don't want to keep them as "pets." Remember to photo document or even film the unveiling of the bin and the vault.

Now, it's time to open up the veggie vault! Be sure to open up your Veggie Vault in a place with open air ventilation. It is bound to be extremely stinky! Impermeable gloves are also a necessity! Follow the same procedure for the vault as you did for the worm bin. Once data has been collected decide as a group where to put the food waste. (Hopefully the kids will want to put it in the compost system at this point!)

After collecting data, now it's time make some sense of it. Have students put their information on the group data chart. Now with the whole group, look over it for differences between the first and second data sets. Start with the worm bin. How did the food waste change in appearance and smell? Did the weight, length and

width of the food items increase or decrease or stay the same? Have kids journal for just 1 minute on why they think those changes may have occurred. Now repeat this process for the veggie vault.

Wrap up (*5 minutes*)

Once students have recorded their own answers, discuss the results and what they think is the best explanation for those results. Compare the group hypothesis to the results out loud. Finally, ask students to reflect on what they learned from this experiment about food waste, decomposition and landfills. This could be a silent journaling activity or a group discussion. After this consider leading a discussion to help students connect their findings to food waste in their own lives. Is there anything we can do to reduce the food waste in the cafeteria at school? What is already being done? How about at home? What is something my family might be able to do?

They can also add pictorial representations of composting to their mural.

Adaptations

To simplify see Day 4

To add complexity

Option A: have the principal or another person from the school come to hear from the students about their findings and suggestions on ways the school might reduce its food waste going into the local landfill.

Option B: If there is time, have students write letters to the school principal asking about how food waste is being disposed of and suggesting that they consider composting it.

Rainy Day: Lesson can be completed outside or under a covered area with good ventilation.



Fun in the Dirt

Day 10 Collage Completion and Dirt Cup Party

Target Grade Levels 3rd – 5th

Essential Questions

Is soil made up of living and non-living components and is it essential for the production of food?

Objectives

Students create a diagram to explain the benefits of compost systems such as vermicompost or mass scale composting facilities. Students identify actions steps each individual can take to reduce food waste going into the waste stream.

STE(A)M Integration

Synthesis of scientific concepts learned.

NGSS and/or Common Core Standards

5-LS2-1 Develop a model to describe the movement of matter among plants, animals, decomposers and the environment.

Lesson Length 50 minutes

Offsite Prep 30 minutes

Onsite Prep 15 minutes

Summary

Students will work collaboratively as a group to complete their collage to represent their understanding of the unit's big ideas. Additionally, the group will make dessert "dirt cups" (chocolate pudding, gummy worms, and crushed oreos) to celebrate and discuss ways they can use what they learned to help reduce food waste.

Background

Today is a day for the students to reflect, make meaning from their experience and celebrate! Preparing by identifying age appropriate reflection questions is very important.

Traditionally dirt cups are made with chocolate pudding, crushed oreo cookies and gummy worms. There is no getting around the dessert nature of this recipe, but there are ways to incorporate delicious and nutritious foods. Here are two ways:

1. Substitute chocolate avocado mousse for chocolate pudding. Here is a simple recipe: <http://allrecipes.com/recipe/chocolate-avocado-pudding/>
2. Have adventurous students tear miniature "leaf mulch"/"worm food" in the form of kale or spinach in between or above the oreo layer.

Procedure

Introduction (5 minutes)

Explain that for our last day, we will finish our collage so that we can share what we learned with the rest of the school by posting it up in the hallway. Also share that once the collage is completed, we will spend the rest of our time making a fun dessert to enjoy called "dirt cups."

Materials

- Recipe
- Dirt Cup ingredients
- Cups
- Napkins
- Construction paper
- Scissors
- Glue
- Tape
- Journals

Garden Connections

NA

Evidence of Learning

Collage style diagram that incorporates the decomposition cycle (life, death, decomposition, soil enrichment). Group discussion about action steps they can take to make a difference

Key Vocabulary

ecosystem, soil, inorganic, minerals, organic, decomposition, mulch, microorganisms, macro-organisms, invertebrates, insects, worm castings, food web, food waste reduction

Activity (40 minutes)

Give students 10-15 minutes to add final components based on what they discovered over the last five weeks.

After the collage is complete, tape it up in the hallway for the group to admire. If possible, arrange for an administrator or teacher to be present and hear from the students about what they included in the collage and how those parts contribute to the health of the soil and our health.

After the collage is completed and hung up, it's time for the dirt cups! This is a classic soil science inspired dessert. It is a simple and delicious treat. Start with a cup, chocolate pudding, Oreos, Gummy Worms and spinach or kale. Add 1/3C of pudding to each cup. Now hand 1 oreo to each student to crumble over the pudding. The pudding can represent the clay sediments, and the oreo can represent the sand sediments, have students mix it together to make a "loam" if they want to. For those who are willing, now add tiny torn up pieces of a leafy green like kale or spinach. This represents mulch or worm food! Finally, add the gummy worm! Voila, the dessert is ready to be enjoyed!

Wrap Up (5 minutes)

Share your sweet treat! If the group is interested, hold a conversation about what they will each consider doing to help reduce food waste at school or at home.

Adaptations**To simplify**

Prepare the pudding ahead of time. Pre-crush the Oreo cookies.

To add complexity

Prepare the mousse with the students according to the [AllRecipes.com](https://www.allrecipes.com/recipe/238927/mousse/) recipe.

Rainy Day: This is an indoor activity.